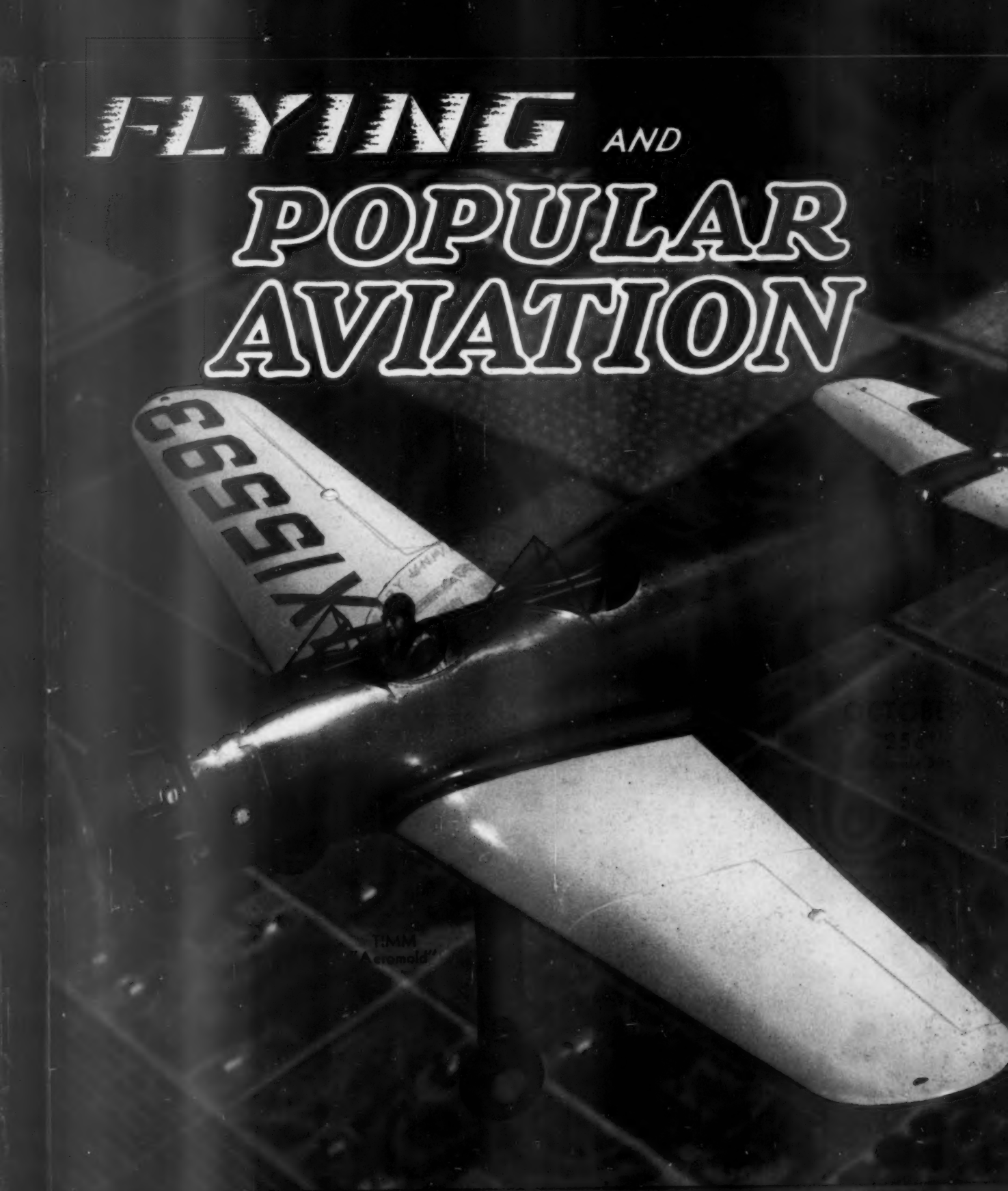
FLYING AND POPULAR AVIATION



AIR POWER WILL DOMINATE THE PACIFIC by General William Mitchell

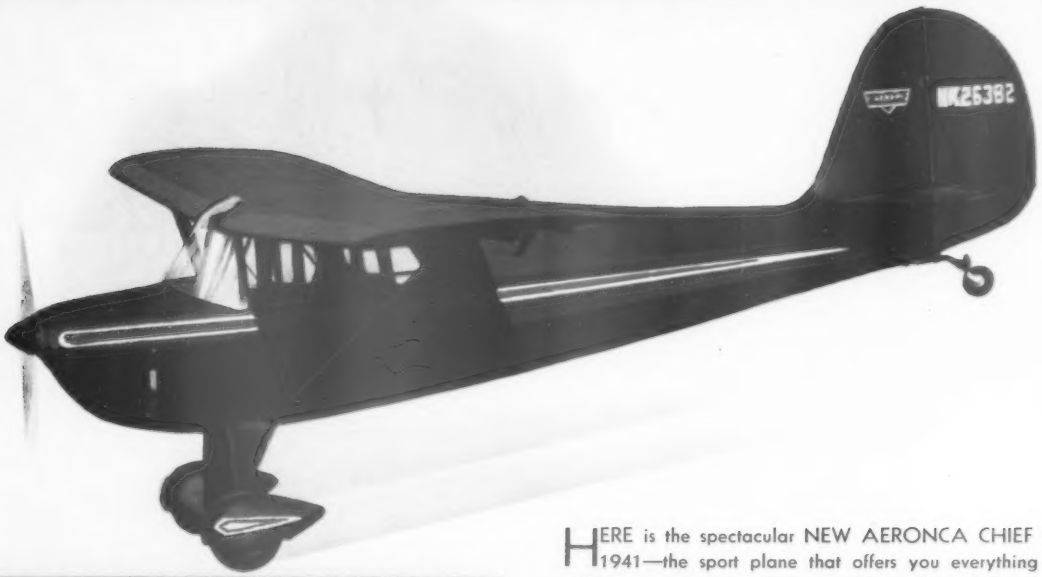
THE REAL NAZI TERROR by Robert J. Winston

100,000 PILOTS NEEDED!

650 USED PLANES
See Page 92

You Get the "BIG 3" in the New 1941

AERONCA SUPER CHIEF



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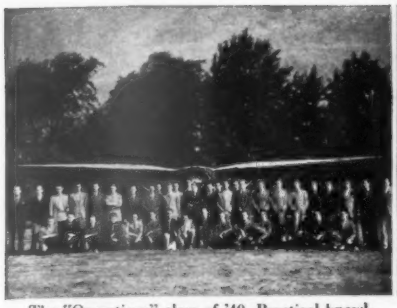

The "Operations" class of '40. Practical knowledge is gained through actual operation of a scheduled airline.

At the ticket desk, reservations, cancellations and other problems are handled by a student ticket agent.

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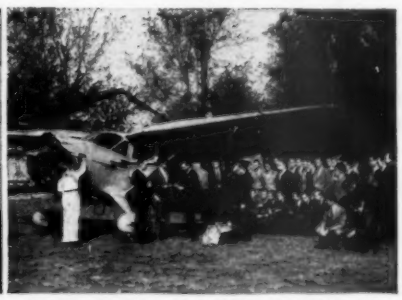
Studying weather reports, the student meteorologists draw weather maps, make predictions prior to each scheduled flight.

With two-way radio, the co-pilot in the plane keeps in contact with the ground station during the trips.



The class watches checking of express and mail while line mechanics make final inspections prior to a scheduled flight.

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BECAUSE the heads of our Government, the Army and the Navy have consistently ignored the warnings of men like the late Billy Mitchell, our country is in far greater danger today than it needed to be. The men to whom is entrusted the safety of this nation are only now beginning to admit—and grudgingly at that!—that Billy Mitchell was right. Let's look back *11 years* at some of the things Billy Mitchell said in FLYING AND POPULAR AVIATION and see why the American people today are justified in demanding an explanation:

"All our old conceptions of navies and military strategy have to be changed, so great has the influence of air power become." Today, 11 years later, our representatives in Washington still are quibbling over contracts for sorely needed aircraft. Hitler tolerates no quibbling; his *is*—not "will be"—the biggest, deadliest air force on earth.

Despite the fact that British aircraft carriers have proved almost useless (remember the *Courageous* and the *Glorious?*), the Navy Department has spent—and is spending many more—millions upon millions of dollars for new aircraft carriers. Eleven years ago Billy Mitchell said: *"There is nothing whatever to fear from so-called naval airplane carriers, because not only are they unable to operate efficiently on the high seas, but even if this were possible, they could not place sufficient aircraft in the air at one time to insure a concentrated operation."*

At this moment our Pacific fleet, with about half the number of aircraft it should have, is cruising warily in the vicinity of the Hawaiian Islands, its eye on the hungry Japanese. Eleven years ago Billy Mitchell said: *"The American people ought to be informed what a terribly dangerous position we have been put in by basing our defense of the Pacific on the Navy instead of on air power . . . the possession of the Hawaiian Islands depends primarily on who controls the air above them."*

Within the last year or two our Army and Navy simultaneously "discovered" that Alaska is extremely vital to the defense of this country. Now Congress is pouring millions into Alaska in a frantic effort to close this country's back door before it is too late. Eleven years ago Billy Mitchell said: *"Outside the United States proper, Alaska is our most important point with regard to our protection against Asia . . . Alaska is within striking distance of any place we want to approach in Asia, either commercially or in a military way!"* Shortly afterward, he added: *"There are only 52 miles of water separating Alaska from Siberia. It is along these lines that future*

(*Continued on page 90*)

FLYING AND POPULAR AVIATION

Trade-mark Registered

Volume XXVII Number 4

Contents

OCTOBER, 1940

Air Power Will Dominate the Pacific	Gen. William Mitchell	10
The Real Nazi Terror	Robert A. Winston	16
Hawks' Nest		19
Pilots Needed!	Malden G. Bishop	20
Britain's Latest (full page photograph)		23
"Photo by Groenhoff"	E. Jay Doherty	24
Radio for Your Lightplane	Moulton Taylor	26
Airman-Journalist	Jack Stark	29
I Learned About Flying from That!—No. 18	Wayne F. Lansing	31
Are You Qualified?	Hurd Barrett	32
Multiple Stooge	Kurt Rand	35
Aviation's Apostle	Richard Martin	37
Flight Instruction from the Ground	John R. Hoyt	38
The Water's Fine!	Lawrence Ward	40
Greeks with Wings	Frank Cunningham	42
Modern Veteran	George R. Reiss	45
40 Planes Started Something	Robert Kleckner	47
Aero Fuels Today and Tomorrow	B. Orchard Lisle	49
Data Book		51
Applied Aircraft Aerodynamics	Raoul J. Hoffman	53
Have You Seen?		54
This Month's Model	Paul W. Lindberg	56

Cover Photograph by Walter Hayes

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ZIFF-DAVIS PUBLISHING COMPANY
Editorial Offices: 608 S. Dearborn St., Chicago, Ill
Member of the Audit Bureau of Circulations.

FLYING AND POPULAR AVIATION is published monthly by the Ziff-Davis Publishing Company at 608 S. Dearborn St., Chicago, Ill. William B. Ziff, Publisher; B. G. Davis, Editor; J. Fred Henry, Vice-President; Max Karant, Managing Editor; Wesley Carty, Associate Editor; B. Carl Capehart, Advertising Manager; Herman R. Bollin, Art Director. New York Advertising Office, 381 Fourth Ave. West Coast Advertising Representative, Jess Laughlin, 416 W. Eighth St., Los Angeles, Cal. SUBSCRIPTION RATES: In U. S., $2.50 per year, single copies 25 cents; in Canada, $3.00 per year, single copies 30 cents. Other foreign subscriptions $3.50 per year. Entered as second class matter, July 16, 1940, at the Post Office, Chicago, Illinois, under the act of March 3, 1879. Contributors should retain copy of contributions. All submitted material must contain return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Accepted material is subject to whatever adaptations and revisions are necessary to meet requirements. Payment will be made at our current rates upon acceptance and, unless otherwise specified by the contributor, all photographs and drawings will be considered as constituting a part of the manuscript in making payment.

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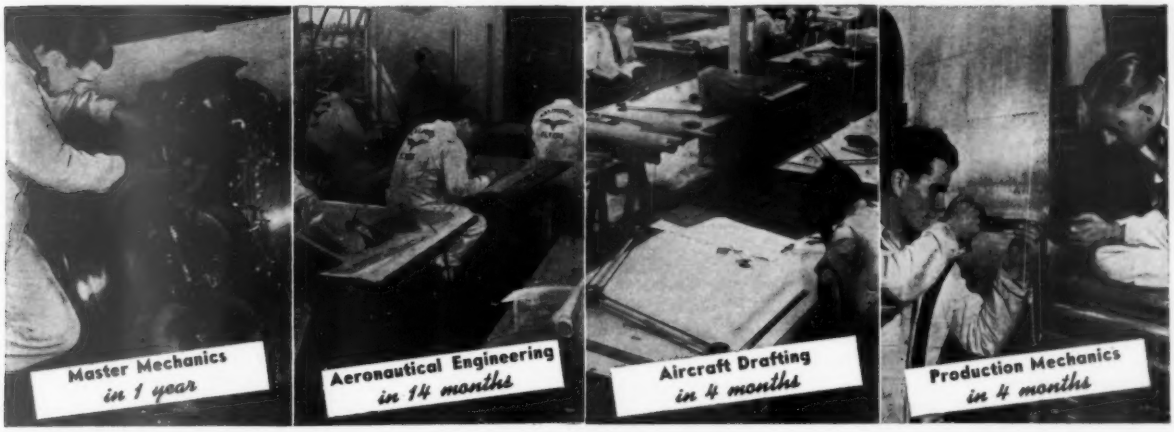

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The Birdmen's Perch

For several years now, we've been printing a trick math problem in each issue of the Perch. Some have been sent in by contribs whose names we wish we could print in gold. Most of 'em we've had to dig up ourselves—an increasingly tough chore. If you know a sticker, please shoot it at us. If we can use it, we'll print your name . . . in boldface, black type, anyway.

Major Al Williams, alias "Tattered Wing-Tips," Mgr., Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

NEW BUSINESS DEPT.

Not long ago, we saw a whole collection of Navy Aircraft Insignia. At least half of which—though we've seen them a hundred times—drew a smile from us for their cleverness.

Come to think of it, there are some pretty fine private plane insignia, too. Some of which might be interesting enough to reproduce in the Perch. If you know of any . . . or have any ideas, send them along with permission to print. Doesn't make any difference how rough your drawing is, our artist will take off the jagged edges.

KEEP IT CLEAN

The gent waving the admonitory (how-zat?) finger isn't cautioning the other lad to raise the moral altitude of his jokes.

What he's doing is stressing how important it is to use an oil in your engine that *stays* clean. Yes, sir, whether you're telling jokes in mixed company or pouring oil into your engine, "keep it clean" is a pretty good rule to remember.

You see, Gulfpride follows that "keep clean" rule because it's been cleaned up *before* it goes into your engine! You know what an awful beating oil has to take in an engine. Sometimes it just can't help breaking down a bit. And every oil contains gum-and-sludge-formers that cause trouble when the oil begins to break down.

We've licked that problem to a great extent. First, because Gulfpride Oil is hard to break down. And second, because the exclusive Alchlor process, by which Gulfpride is refined, has *removed* up to 20% more carbon, varnish, and sludge-formers. Gulfpride Oil *starts out* cleaner . . . and *stays* cleaner!

FOG-BOUND

A pilot we know found himself grounded in a deserted, emergency landing field. He had with him exactly 1 4/5 packs of regulation-size cigarettes.

Waiting for the weather, he not only smoked the whole initial supply but also pieced together the butts with cigarette paper, finding that he could make a complete cigarette out of every half-dozen ends.

Before the sun shone again, he'd finished 'em all. How many cigarettes did he smoke?

(Think you know the answer? We'll bet you miss it, as we did. Send your figure to T.W.T. to be checked. We'll get the official version out by return mail.)

THIS MONTH'S WHOPPER

Dear Major:

Here's my Doctor's Thesis for the Whopper Diploma, and, if every word of it isn't true, then I'm a suck-egg liar.

Last year I'm doing a little barnstorming through the corn country, and, frankly, business didn't exactly boom. The local sports stood around my plane, starin' and spittin' tobacco juice at her, but they just weren't buying!

"C'mon, boys," I says, "this one is on me. Step right in an' experience all the thrills of flyin' like a bir-r-r-r-d!" After that one had sunk in for about ten minutes, a lad stepped up, bobbed his Adam's Apple at me a couple of times, and said, "Shucks, Mister, I don't care if I do."

Now there may be taller, leaner lads than my new customer, but if there are I don't know where to find them.

Well, I check to see that my tank is full of good Ol' G.A.G., an' off we start. I figure I'll give this fellow a run for his money, so after gainin' a little altitude, I try an Immelman. It was a good Immelman, understand, but somethin' wasn't just right. There was a drag to her I never experienced before with G.A.G. in the tank!

I'm gettin' a little discouraged at this point so I decide to land. I look around to see how my passenger's makin' out. Darned if he didn't have one of his long legs over the side, draggin' his size-14 foot on the ground!

Well, I take my goggles off and sigh a long sigh. "Look, brother," I says to him, "I don't want to seem inquisitive, but you been draggin' one foot on the ground?" "Yep," he answers, "I sure have, all the time we been up there. I never rid in one of these contraptions before an' I ain't takin' chances. I ain't no fule!"

An' just to think—all the time I was suspectin' that G.A.G. I should have known better!

Jim Norris

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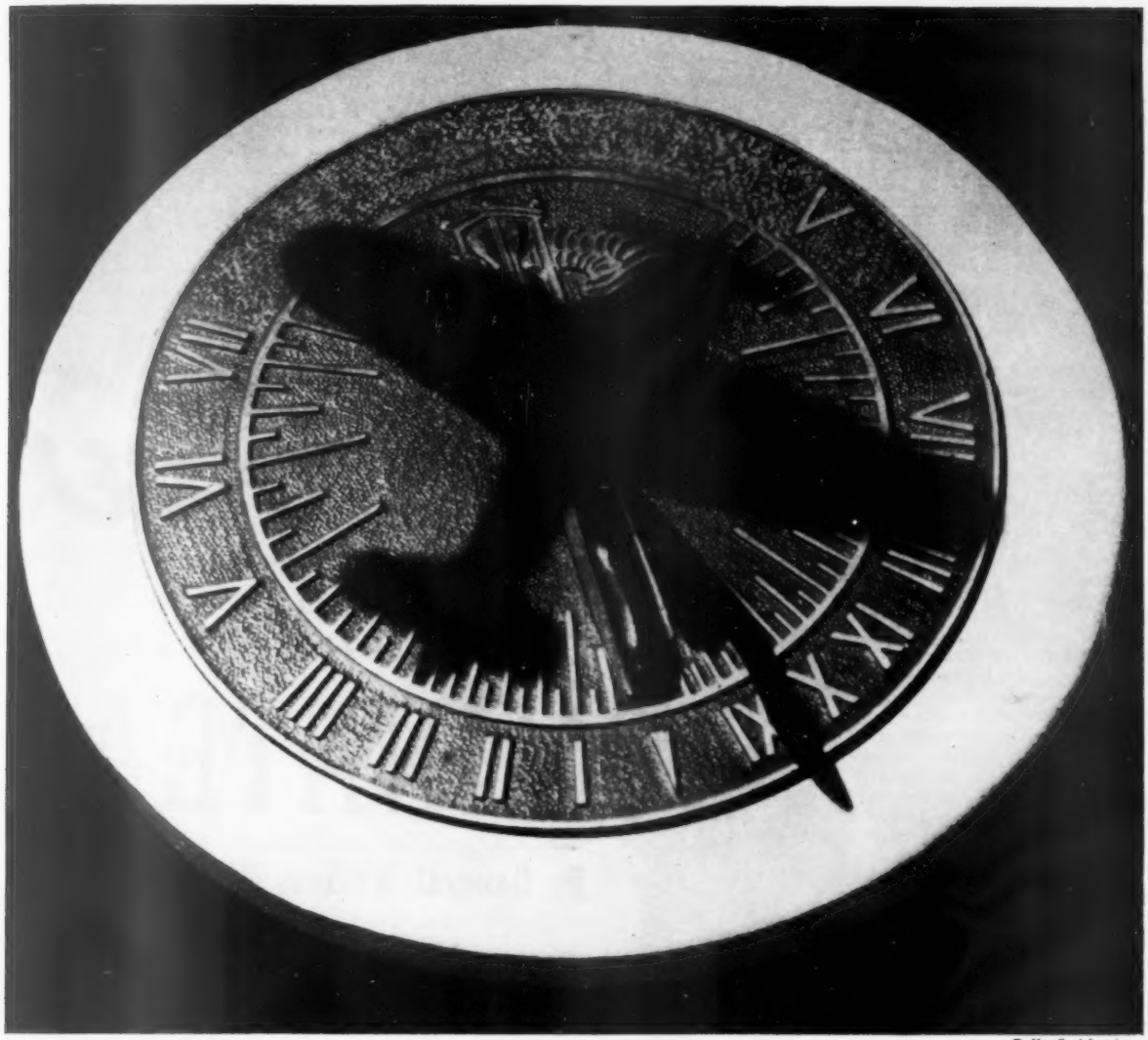

Polly Smith photo

TIME FLIES TOO

Moments have wings. Each tick tock of the clock means a precious moment has flown out of your life forever.

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Air Power WILL DOMINATE THE

By General William Mitchell

"Have an eye to the Pacific," the late Billy Mitchell warned in 1929, foreseeing the Japanese invasion of China and the routes of war flown today by Clippers.

THE rumblings of impending war in Asia between the Muscovite and Chinese, the attentive attitude of the Japanese, ready to seize any pretext for the occupation of the Asiatic mainland, the interests of the United States in Asia and regard for our possessions of Alaska, Hawaii and the Philippine Islands, all make it necessary for us to "have an eye" to the Pacific and Asia. This applies not only in a military way but commercially as well.

The first three articles that I wrote for AERONAUTICS (POPULAR AVIATION'S *name in 1929.—Ed.)* dealt with the general condition of aviation in the United States, how it has been and is being mismanaged by the present administration, and something about the use of air power in the Atlantic Ocean and in the vicinity of our Panama Canal. In this article, I shall treat of our air power in the Pacific and what it means to us as a nation.

Strategically, the American position with respect to the Pacific Ocean is a very strong one. Most of us have a very hazy idea as to what strategy means. With armies, the side that "got the mostest men there firstest" excelled in strategy. With a navy, whoever got the "mostest ships there firstest" excelled. With air power, the one who gets the "mostest airplanes there firstest" is the strongest, whether it be in a commercial or a military operation. Although our position in the Pacific was very strong before the advent of air power, since that time our potential strength has been immeasurably increased if we take advantage of what the air offers us.

We are the only great white power the home shores of whose territory are washed by the Pacific Ocean. Opposite us is the continent of Asia, containing some 950,000,000 people, or one-half the population of the world. It is with the people of Asia that Europeans have always sought to trade and, in many cases, this has resulted in war not only with Asia, but also between the European nations themselves. The World War was fought largely over who should control the trade routes to the Far East and in the Pacific.

Today, with our Diesel-motored sea vessels, we need no bases nor refueling stations in the Far East as sailing vessels and coal burning steamers used to. A motor vessel can take on its fuel oil at San Francisco, go to Shanghai or Canton, China, and return home without refueling.

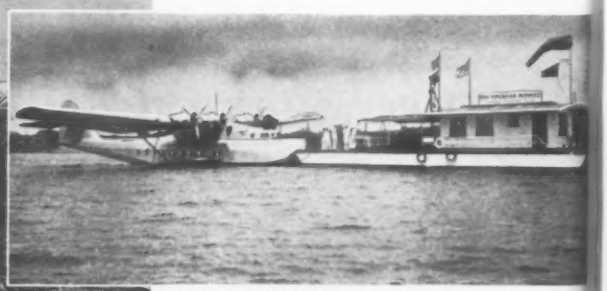
Traffic by air has changed the lines of communication from one country to another. The routes of commerce and what are known as lines of operation in war (the lines along which war is made) always follow each other. Before the coming of air power, when vessels and warships were the only means of traveling the seas, the line across the Pacific was from San Francisco to the Hawaiian Islands, thence across to Japan or China; but with air power, the shortest route is by way of Alaska.

Alaska is really the key point to the whole Pacific Ocean. It almost touches Asia, the distance across the Bering Straits being only 52 miles with two islands—the Diomedes—in the middle, which are only six miles apart. One belongs to Russia and the other to the United States. Attu Island, at the end of the Aleutians, is no further away from Yokohama, Japan, than is Manila in the Philippines. Airplanes can fly there and back without taking on additional fuel.

The point I wish to emphasize is that we are so situated that from United States territory on the continent of North America not only merchant ships but aircraft

Guam (left), on the base of Mitchell's Pacific triangle, has a strategic flying boat base.

Peaceful Clippers with mail, passengers now use Guam (below); war would bring in Navy.



PAN AMERICAN AIRWAYS

U. S. NAVY

Navy PBY's patrol Alaskan coast near apex of vital Pacific zone.

PACIFIC...

EDITOR'S NOTE

General Mitchell's warning of America's danger of aerial invasion from Europe, antedating President Roosevelt's; his accurate description of Panama's defenselessness both are uncanny. Recent weeks turned U. S. attention to the Pacific, Japan and Alaska, make this 1929 article startling prophecy.

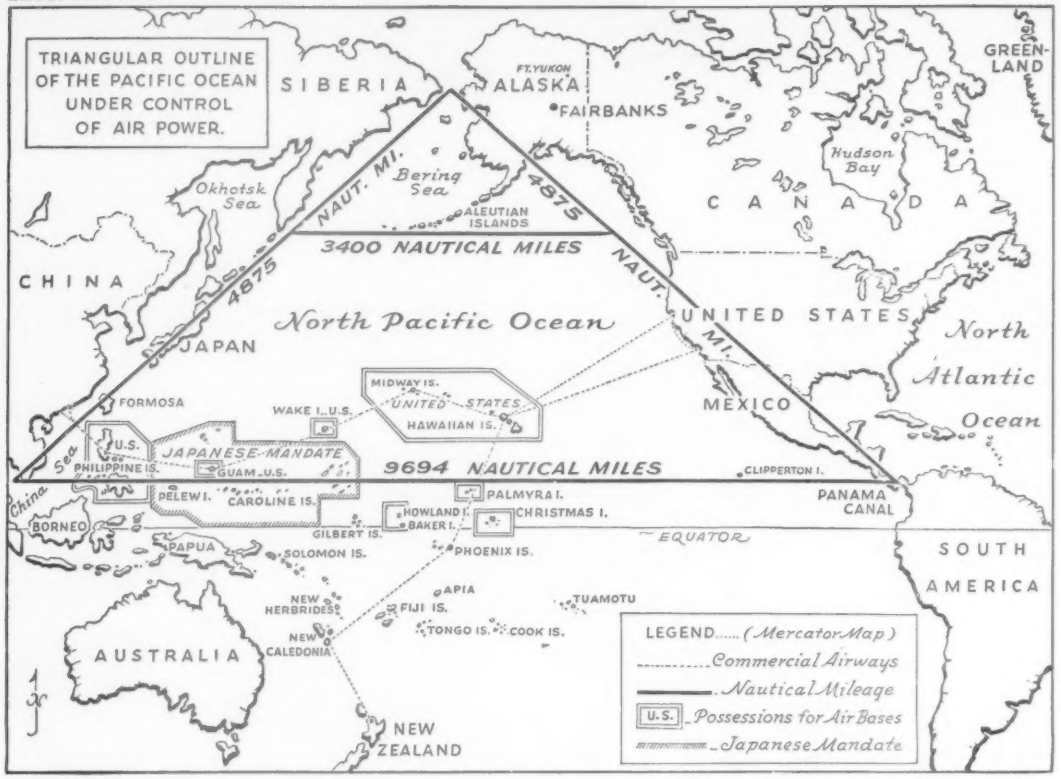
ACME

Mitchell (left) in 1923 with Maj. Gen. H. H. Arnold, now Air Corps Chief, then a Major.

Wake Island, now a Pan American base, would be valuable in wartime.

PAN AMERICAN AIRWAYS

MAPS BY HAL MORRIS



Panama-Alaska line gives U. S. dominance over strategical Pacific triangle. One nautical mile equals 1.1515 statute miles.

are able to go to Asia and return with a single charge of fuel.

Now, the crossing of the Pacific is nothing. It is no more than a ferry between two points across the water. Airplanes can fly from New York to Peking by way of Alaska in some 60 hours *(closer to 40 today.—Ed.)* and to the center of China or even India in 10 or 20 hours more. It is not miles that count in transportation; it is the time required to negotiate the disance. The vast leagues of the Pacific are shrinking continually under the magic of scientific aircraft development. The day is not far off when neither months, weeks nor days will be used in computing the trip, but hours alone. *(Pan American's Clippers fly the San Francisco-Hong Kong route today in about 66 hours' flying time.—Ed.)*

From an aeronautical standpoint it is very interesting to look at the Pacific Ocean in a strategical way. We may consider the north Pacific as a huge isosceles triangle, with its vertex on Bering Strait, one end of the base on the Panama Canal and the other end in the Philippines or the coast of Asia directly opposite. The sides of this great triangle are approximately 7,500 miles in length, while the base measures about 11,000 miles or about half the distance around the earth at that latitude. Along the eastern side of this triangle we find the United States either in possession of, or completely dominating the whole extent of the territory, including that part of Canada fronting on the Pacific Ocean between Puget Sound, the Portland Canal and the southern border of Alaska. In any altercation arising between the United States and an Asiatic power, Canada would either openly side with us or run the risk of occupation.

Freedom of maneuver of a military force is dependent on the length of the base. Taking as definition of "base" the line which connects the military depots or magazines of a country, the United States has a base of 7,500 miles from Alaska to Panama. Any part of this base may be reached either on or over the land and all elements for the raising, concentration and maintenance of military power is to be found within its borders.

The western or Asiatic side of this triangle is very different from our side. The coastline still is greatly indented so that a straight line drawn from any one place along its coast to another usually passes a considerable distance seaward. A fringe of islands covers the coast of Asia all the way from the Peninsula of Kamchatka to the Equator, varying in distance to the mainland from a very few miles (as at Sakhalin Island) to 100 in the case of Japan and about 500 in the case of the Philippines and Borneo.

These islands are rich by nature, capable of great development and bear very much the same strategical relation to the continent of Asia that the British Isles do to the continent of Europe. In other words, if the islanders in times past were able to dominate in sea power they rendered themselves not only immune from attack from

Clippers (this one at Wake Island) fly San Francisco-Hong Kong trip in 66 hours.

Top-of-the-world distances, shortened by planes, are important to our defense.

the mainland but they had the power of initiative against the continent. The strategical development of Japan in this respect has not been unlike that of Great Britain. Hence, we find the policy of Japan to be the complete dominance of all these Asiatic islands, not only as a means for her own military protection but also for furthering her interests on the continent.

Another strategical similarity between Japan and Great Britain is that the latter finds the European continental air power to be the greatest menace to her existence *(Note this prophecy!—Ed.)*. Practically everywhere on the continent of Asia we find a population more or less hostile to the Japanese. Japan therefore will develop her air power to the utmost. Insofar as the application of her air power is concerned, Japan has the line Formosa-Kamchatka exclusively available, or a distance of about 4,000 miles.

Surveying the two sides of the triangle we find our side to be a homogeneous strategical entity complete in itself and menaced only from across the Pacific, while on the west or Asiatic side we find an insular empire occupying a base a little more than half the length of one side of the triangle and menaced strategically both from the Pacific and the continent of Asia.

At the base of the triangle, or the Panama-Manila line, we find an expanse of 5,000 miles of ocean to the Kingman Reef, owned by the United States, but from there on a practically continuous series of islands within short distances of each other, clear to the coast of Asia. These islands are either in the possession of or entirely dominated by Great Britain. The only land encountered between Panama and the Kingman Reef is Clipperton Island, about 1,900 miles west of Panama and claimed both by France and the Republic of Mexico. The United States should acquire this at once. England, through her foothold on these islands, combined with her air and sea power, should be able to control about half the base of the triangle. This, joined up to her base Singapore-New Zealand, covers all the rest of the Pacific Ocean.

Having taken this hasty survey of our strategical position, let us consider what is necessary to establish a military depot, sometimes erroneously called a base. It can be said at the outset that by far the easiest depot to organize is an aeronautical one, which at the same time has command of power much superior to that of an army or a navy. An army may occupy a position and, if given a few days to prepare it for defense, may develop it to almost as great an extent as if they had been there for a protracted space of time. If its communications are squarely behind it and if hostile ground forces have to come across the water, it has little to fear from either land or sea, its only menace being from air power. On the other hand, if an army catches a fleet in a harbor, the army may destroy it, there having been such examples at Cervera at Santiago, Makaroff at Port Arthur, or Napoleon's capture of the Danish fleet with his cavalry when it was frozen in the ice.

A navy, to establish a depot, must first seek out a harbor with a depth of water of 40 feet at low tide, otherwise a wounded battleship will be unable to enter it. If it is not accessible at all times, when it is needed the most will be just the time that it cannot be entered.

With the complexity of modern naval armaments has come a corresponding augmentation of shore establishments. The dockyards take years to build, the technical repair and supply facilities require not only vast sums of money, but infinite attention to detail and a great deal of time. This is rapidly becoming so intricate a proceeding that fleets are growing less and less mobile, are chained to their depots and, with every change of the theatre of operations, require a new arrangement of supply points. Any application of sea power at a distance of over 2,000 miles from its base necessitates years of preparation and not merely millions but billions of dollars' expenditure. As naval preparations increase in size and extent, just so much do they become better targets for air attacks and, as the utility of the great surface battleship is rapidly drawing to a close, most of the effort expended in large surface naval armaments is a waste of energy.

An air force, on the other hand, can establish itself with the greatest ease. An unoccupied field, a stretch of ocean beach, even the center of a volcano may be occupied and operated from with a minimum of preparation, compared to the installation of a naval depot or the emplacement of artillery of position. The First Bombardment Group landed on and operated from Hatteras Island along our Atlantic Coast *(In 1929.—Ed.)* with little preparation. All their supplies, including 2,000 lb. bombs, tractors, gasoline and fuel, were landed in

(*Continued on page* 58)

PAN AMERICAN AIRWAYS

SPEEDING UP NATIONAL DEFENSE

A SYMPOSIUM

The editors of FLYING AND POPULAR AVIATION, seeking an answer to the question "How can the United States Government best use American industry so as to facilitate immediate expansion of our air forces and eliminate dangerous delays?", interviewed the following industrial leaders:

WILLIAM S. KNUDSEN

Chairman, National Defense Advisory Commission

William S. Knudsen

THE industrial facilities necessary for expansion of our air forces are being organized along the lines already laid down. The Congress has been at work on legislation and appropriations. During this period the National Defense Advisory Commission has been meeting with representatives of the aircraft industry. At the conclusion of the meetings, the manufacturers took voluntary action to assure full speed ahead on the aerial armament phase of the program. They agreed to sign fixed fee contracts, avoiding possible delay due to technical and legal difficulties to be ironed out by legislative enactment. The manufacturers pledged hearty support and co-operation.

Since the defense commission was appointed, this department has sought to lay a solid foundation upon which the resources of industry would be co-ordinated. At the same time, every effort has been made to expedite current contracts for defense material. Progress in connection with the first objective has been substantial and, with the continuing co-operation of industry and the interested Government agencies, we can be confident of a production machine capable of attaining the definite goal specifically stated in the requests now before Congress. This can be accomplished just as far as the best production facilities and techniques in the world can gain momentum through favorable Congressional action upon this augmented program.

There are problems and responsibilities in mechanical production which, naturally, are not thoroughly comprehended by the general public. What may seem to some as unnecessary delay is almost always, in reality, a period of basic preparation necessary to sound achievement. There is scarcely an air defense instrument which does not depend for its production upon the machine tool industry. This industry was the first and most important potential bottleneck which this department confronted. It was considered immediately and steps were taken to work out a prompt solution.

Through the unlimited co-operation of the industry, I am able to state that the machine needed will be ready in time to prevent a serious delay. The machine tool builders have furnished a good answer by their own example of making their facilities available to the defense program on a voluntary basis as completely and effectively as though wartime priorities were in effect.

Let me cite the fact that an analysis has been made of current and expanded rates of delivery for British account. In this connection it should be said that the British proposals for expanded procurement of aircraft in this country do not threaten interference with maximum production of our own needs, inasmuch as they would be handled independent of capacity required for the maximum American program. Estimates have been completed on required capacities for airplanes and engines and there is every indication that the industry will be able to meet the heavy requirements placed upon it.

COL. FRANK KNOX

Secretary of the Navy

Col. Frank Knox

THE Navy Department, in developing aviation to assist to the maximum in the first line of our defense, has always enjoyed the close and loyal co-operation of industry. And this, I believe, is the answer to the question which is asked here. For it is only by continuing this policy of co-operation that we can hope to facilitate immediate expansion of our air force. We in Government must let industry know exactly what we want and let them know as nearly as possible under what conditions they are expected to operate.

There seems to be no need for any fundamental change in our present policy. Certainly, we would have no reason to take over control of the industry nor to attempt any closer supervision than we now maintain. I believe that industry can do its own job efficiently. The most important thing that could be done in Washington at this time would be to clarify the tax policies. At this time, legislation which establishes the exact nature of excess profits taxes is pending in Congress. Some definite settlement of this tax question must be made so that the contractors can know what they are up against. When you ask a man who has been producing 20 planes a month to expand his plant to produce 200, you must give him assurance that he is not going to be ruined by taxes which he does not anticipate. Let everyone know just where he stands.

That the ultimate success or failure in the field of aircraft operation depends to a large degree upon material is well known. The Navy has learned that material and apparatus that will stand up and do their job through gunfire, that will withstand moisture and salt spray and overcome all other hazards encountered in the Navy must meet the strictest specifications. Intensive research in the laboratories of the Government and of private industry has accelerated the development of service equipment. And if we are to improve and expand our air forces, we must expand our research activities and make the results known to all. We have certain immediate goals, but must not lose sight of the future. We can lay the groundwork of co-operation between Government and industry so as to attain our present objectives and can, at the same time, build for the years to come. There is a tremendous job to be done, because we all know that the best in aviation is yet to come.

GUY W. VAUGHAN

President, Curtiss-Wright Corporation

Guy W. Vaughan

AT a meeting of aircraft manufacturers with the Air Corps and the National Defense Commission in Washington recently, there was every evidence of real progress being made toward the elimination of the legal and financial technicalities standing in the way of the President's national defense program. The Commission, Army, Navy and other branches of the Government are co-operating closely with the industry to avoid delays in getting under way.

The industry unanimously agreed to proceed with the preliminary work and procurement of materials necessary to produce airplanes, engines, propellers, etc. In accordance with the schedules submitted by the Army and the Navy, it is further understood that contracts will be ready for execution by the industry very shortly.

EMMETT F. CONNELY

President, Investment Bankers Association of America

Emmett F. Connely

OUR present state of unpreparedness has created in the minds of many a feeling of emergency and emergency in turn implies the need for drastic action. For instance, the suggestion has been made that it will be necessary for the Government to supply the capital funds for additions to our productive facilities, particularly as regards the aviation industry. This ignores the fact that investment bankers in recent years have provided millions of dollars of new capital for this growing giant. Furthermore, it disregards the fact that Government arrangements during the first World War failed to attain the desired results. At that time Congress appropriated $640,000,000 for aviation, but the war was over before a single American-made plane reached the front. Let me quote from a Senate Committee report on this fiasco:

"The production of combat planes has thus far been a substantial failure. We had no design of our own; neither did we adopt any one of the European designs until months after we entered the war. . . . Two of these have been abandoned after the expenditure of much time and money. . . . a remarkable illustration of procrastination and indecision. . . . Designs and specifications were offered to our officials as early as May, 1917. . . . They decided upon the manufacture of a number of sets of parts about January, 1918."

As to blame for this situation, the Senate committee declared: "Your committee is convinced that much of the delay . . . is due to ignorance of the art and failure to organize the effort in such a way as to centralize authority and bring about quick decision. A certain aloofness in dealing with persons possessing information based upon experience . . . and a failure of the officials in charge of the work to grasp the situation in a broader way."

We are in an emergency and emergencies do require drastic action. Before we advocate an entirely new method of financing essential construction, however, let us intensify our efforts along the lines that have made America the greatest industrial nation in the world. Private capital is anxious and desirous of going to work and the investment banking profession stands ready today as ever to raise these funds, allowing the management of successful aviation enterprises and the now idle funds of private investors to work hand in hand to enable us to reach our goal with a minimum of delay and disappointments. All that is necessary to attain this end is for our duly elected Government officials to remove the brakes that now restrict enterprise and eliminate those deterrents which have been preventing the flow of capital funds into industry.

The first essential is a more co-operative spirit between Government and industry. Suspicion and hostility must give way to a recognition of mutual responsibility. Neither Government nor industry can pull this load single hand. They must work together as a team in team spirit. The day that that spirit predominates, America will become—as she has in emergencies in the past—the unconquerable nation our forefathers envisioned.

Times are critical—beyond belief or comprehension—but if we will all set our shoulder to the wheel, make national defense our own personal job, I have faith that we will not only survive, but that we will preserve our present system of democracy so dear to us all.

WILLIAM GREEN

President, American Federation of Labor

William Green

IN the interests of national defense it is imperative that the capacity of the American aviation industry to turn out fighting planes be immediately and greatly expanded. This would require prompt construction of many new airplane factories. In my opinion, the United States Government can best facilitate this emergency expansion program by guaranteeing loans from private lending agencies to private industry for this purpose. The loans could be guaranteed by the Reconstruction Finance Corporation or some other appropriate Federal agency.

The American Federation of Labor favors such a program because it would be helpful to national defense and because it would create thousands of new jobs for those now unemployed. It must not be forgotten that the solution of the unemployment problem is a vital factor in strengthening our national defenses. Maintenance of a large army of unemployed plus vast expenditures for rearmament together constitute too great a drain on any nation's resources.

Industrial peace is another important element in assuring rapid and successful completion of the defense program. I firmly believe that industry and labor, as well as the Government, have a patriotic responsibility to do everything in their power to further the process of peaceful collective bargaining. This is no time for costly strikes or lockouts. It is definitely the time when the orderly, constructive processes of collective bargaining should be applied more widely than ever before to settle any differences that may arise. Thus, industrial democracy may come to the aid of our national democracy and help to preserve America.

WILLIAM T. PIPER

President, Piper Aircraft Corporation

William T. Piper

FIRST, decide promptly what is wanted and in what quantities. In our plant we use over 300 articles purchased from over 500 sources. Much of this material cannot be had in less than 12 weeks from date of the order. When we speed up, everyone from whom we buy must do likewise. Every inventory must be increased and the Government should make arrangements so that the necessary working capital is available.

Second, all manufacturers are anxious to do everything they can. They wish to work harder and put in longer hours themselves and I believe that in this emergency the hours which can be worked without overtime should be lengthened. There may be millions of unemployed, but they cannot be trained overnight, so we must depend for an immediate increase of production upon our present employes.

Third, stop playing cheap politics. It seems that every move of our present Government is made with an eye to what organized minority wish rather than acting for the good of the country at large. An example of this is the appropriation of $900,000,000 to pay farmers for doing nothing. At approximately the same time, they were so economical minded that they cut the appropriation for the Civilian Pilots Training Program from $7,000,000 to $4,300,000.

Last, try to get value received. We started the last war with a $1,000,000,000 debt and we are going into this crisis with a debt that is nearly $50,000,000,000. It seems as if this is the time to stop making social experiments and everybody go to work. It we do not we will be easily defeated by any aggressive nation that cares to attack us.

DONALD W. DOUGLAS

President, Douglas Aircraft Co., Inc.

Donald W. Douglas

THE best way to use America's aircraft industry in national defense is to use it. Discussions, conferences, opinions and language will not build wings of defense or keep them in the air.

For some time the aircraft industry has been ready to expand. It has the technical skill, determination and a tradition of great accomplishment behind it. It has, and fully deserves, the confidence of the people. Its record speaks for itself.

To facilitate immediate expansion of our air forces and eliminate delays there must first of all be a clear-cut, courageous policy. Needs of defense and not expediency of politics should guide the nation in emergencies. The Government should determine realistically the costs involved in doubling and tripling existing facilities as an immediate defense measure and should quickly appropriate the necessary funds and put them to work. Production, not profits, is the important thing today. Let's get the production first and talk about profits, or how to regulate them, afterward.

Complete co-ordination of our national resources and our facilities is another vital factor. Everything and everyone contributing to our industrial, economic and national existence must be made to bear equal burdens. Rewards must be balanced with responsibilities. To build our national defense the Government must stabilize everything that goes to make up production.

This is the picture of our problem and the answer to it. We can do it! We are ready! Let's go!

ACME

Heinkel He-111Ks, like this one loading bombs, scored impressive hits on airport at Brussels from high altitudes. They may have bomb sight like ours.

U.S. NAVY

The author, when flying for U. S. Navy.

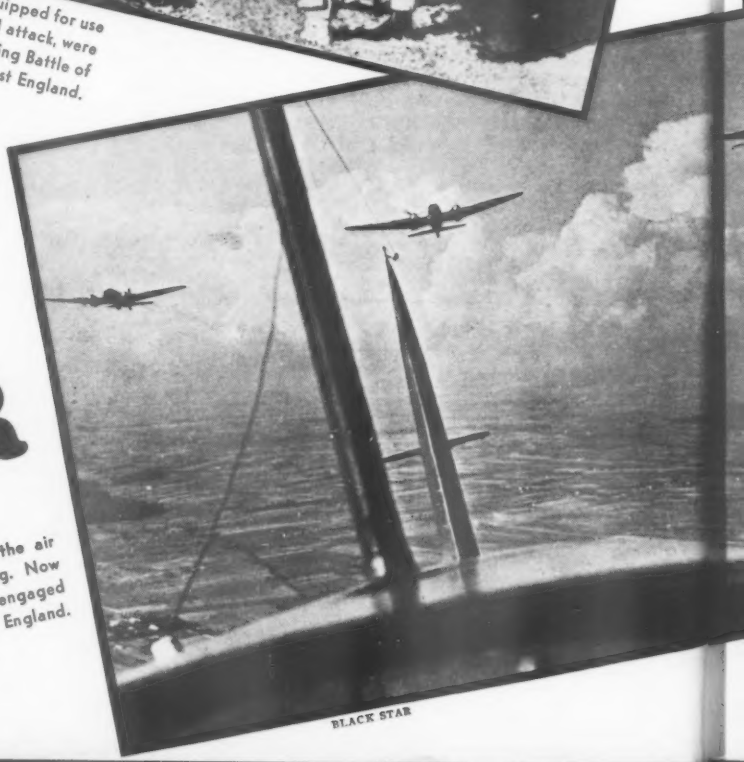
by

ROBERT A. WINSTON

INTERNATIONAL

Dornier Do-215s, also equipped for use as fighters and for ground attack, were used in bombing raids during Battle of France. Now they fly against England.

The REAL NAZI TERROR



BLACK STAR

Hundreds of He-111Ks filled the air over Brussels with their droning. Now squadrons like this one are engaged in daily raids on targets in England.

Not the publicized dive bombers, but high altitude horizontal bombing gave Hitler victory in Belgium and France.

SO much publicity has been given to Germany's dive bombers that the important part played by their horizontal bombers has been sadly neglected. The fact is that a good exhibition of high altitude horizontal bombing is sometimes more demoralizing to a defending force than an attack by the more spectacular *Stukas*. The terrifying, ear-splitting noise of the *Stukas*, usually augmented by sirens to distract and unnerve the ground forces, was bad enough, but such an attack at least gave the defending gunners something to shoot at.

A British anti-aircraft gunner who had fought off such an attack, when asked about his reactions, replied: "Scared? I was too bloomin' busy to be scared." Anyone who is busy firing at a target he can see, such as a diving airplane, has the satisfaction of being able to fight back and has the advantage of knowing just what sort of opposition he is up against. This whole picture is changed when the horizontal bombers come over at high altitude for here uncertainty complicates the defenders' problems. The enemy bombers, invisible to the naked eye, are virtually out of range for effective anti-aircraft fire. Their strength in numbers is unknown. Even their weapons are a secret until the first bombs fall and then there is always the question in every man's mind: What is it *this* time? Will it be thermite or gas or liquid oxygen bombs like those that killed by shock in Barcelona? What new and devilish weapon is about to fall from that clear sky?

Horizontal bombing is like lightning. It may strike anywhere. You can see the effects after it strikes—if you're still around—but you can't see it coming or fight against it. You can hear the thunder of the airplanes overhead, filling the whole sky, seemingly coming from all directions at once. It is the most helpless feeling you can experience. About all you can do is sit and wait, like a blasphemous preacher caught in a thunderstorm, hoping that it isn't a personal visitation of heavenly wrath, but afraid that it probably is.

The most demoralizing factor in such a bombing is that the raiders' weapons are so much more accurate than those of the ground defense. If an indiscriminate scattering of bombs fell over a large area, it would be possible to adopt a fatalistic attitude. You could say: "It can't happen to me" or "If I'm going to get it, I'll get it." But when the "all clear" signal sounds and the damage is found to be confined to an obviously selected, concentrated area, it is apparent that it *can* happen to you and probably will if you happen to be in a similar area when it is subjected to such a bombing.

After you see this demonstrated a few times, the moral is usually obvious: Stay out of such areas. The Germans probably figured this out in planning their bombardments of certain cities. Brussels, for example, could have been subjected to the same sort of unrestricted bombing that devastated Rotterdam. In the bombardment of Brussels on May 10, more than 100 Heinkel He-111's came over at 12,000 feet shortly after dawn in perfect weather. Their objective, the Brussels airport, was marked by a fast sky-writing plane which preceded the bombers so that they had only to follow the smoke trail until they came to a circle over the airport, drop their bombs and zoom out of range. *(Might this indicate that the majority of German pilots are so inexperienced that they must be led to their target by an experienced navigator? —Ed.)*

In watching this demonstration from my hotel window, I saw no defending airplanes rise to hamper the bombers. The anti-aircraft fire was pitifully ineffective. It sounded like an old-fashioned Fourth of

ACME

Waalhaven Airport, Rotterdam, was bombed effectively by Nazis using technique later applied to Brussels airport and French Air Ministry.

INTERNATIONAL

He-111Ks which Germans sent into action over Brussels and Paris had better luck with anti-aircraft fire than this one on English coast.

July and they might just as well have been shooting off firecrackers, for the Germans paid no attention to it. I could see large tracer shells streaking up in the general direction of the raiders, but the bursts were either behind or ahead, above or below. It was disheartening to watch and probably even more so for the defending gunners. Out of several thousand rounds fired from both light and heavy anti-aircraft guns, I did not see one burst that could be judged a hit by reason of any visible effect on the bombers which did not even leave formation. After about an hour of this some of the planes came down as low as 5,000 feet and still the defenders could not seem to get their range.

Meanwhile the bombs were plunking into the airport and the surrounding hangars, putting them completely out of commission. These bombs had a whistling device that was audible for miles so that even a distant drop sounded like a personal caller headed straight in my direction. No doubt this feature helped to distract the anti-aircraft gun crews close to the objective.

During this attack, which lasted for an hour and a half, Brussels was virtually without protection and could have been ruined at will. Such a procedure would have been costly as well as useless. No military gain would have resulted and the bombs and planes necessary were needed at the same time over Holland and France. By thus picking out a definite objective and destroying it the Germans made a much greater dent in the morale of the defenders than if they had ravaged the city by indiscriminate bombing. The Russians made that mistake in Finland: the large city of Tampere was ruthlessly bombed nine different times with enormous damage, yet the Finns had nothing but contempt for the Russian bombers who never came near getting hits on their real objective, an aircraft factory in the suburbs. Such a poor demonstration encouraged the Finns to continue their resistance while the workmanlike job of the Germans only discouraged the Belgians.

The bombardment of Paris on June 3 was conducted along the same lines. Here again the Germans chose to avoid unrestricted bombing of the city from motives which were probably more strategic than humane after their experience in bombarding Warsaw. Their goal here was the capture of Paris which would be the most severe blow they could deal to French morale. Storming the city would have proved difficult and costly for it was surrounded by many fortifications with considerable anti-aircraft protection and a balloon barrage. If street fighting had ever developed, it might have taken the Germans weeks to mop up Paris, house by house, necessarily accompanied by destruction like that in the subjugation of Warsaw. Paris destroyed might have strengthened the will of the French to resist, but the surrender of Paris would make most Frenchmen feel that their cause was hopeless.

How could the evacuation of the government be forced? The answer was simple for all of its spectacular daring: Instead of a shower of pamphlets warning it to move, the government was given an effective demonstration of what would happen if it stayed in Paris. Failure of such an attack would have been disastrous for the Germans for if the raiders had been driven off or if the results had been inconclusive, the French morale would have been strengthened. Accordingly, the Germans threw everything they had into making this one raid a grand slam.

EDITOR'S NOTE: *The author has just returned, via transatlantic Clipper, from the European war zones. A former U. S. Navy airman, Mr. Winston was a check pilot and special representative for the Brewster Aeronautical Corporation in Sweden, Finland, Belgium and France. As an experienced military flyer, Mr. Winston is better able to interpret what aerial warfare he saw than is the ordinary newspaper correspondent.*

The Parisians had been lulled into a false sense of security by the previous aerial operations over their city. There had been plenty of air raid warnings and on some days there had been three or four of these *alertes*, but most of these operations were either reconnaisance patrols, photographic missions or bombings of suburban airports like Le Bourget. Occasionally the sound of distant explosions could be heard, but the Parisians regarded the whole performance mainly as a nuisance that kept them off the streets in fine weather or as something to read about in the morning papers. The war seemed as remote as if it had been on another continent even while the opposing tank divisions were blowing each other to smithereens only a few dozen miles north of the city. If the *alertes* were sounded at night, most people never bothered to go to the inadequate shelter of the nearest *abri* and many people even slept through the noisy wailing of the warning sirens. For a week before the big raid only one *alerte* was sounded in Paris.

On the afternoon of June 3, the raid went off like clockwork at 1:15, lasting almost exactly an hour. The objectives for this demonstration were the Air Ministry and the Citroen automobile factory nearby. It was a perfect summer day with high scattered clouds. Over 200 bombers flying at an altitude of around 21,000 feet slammed their salvos right into the targets. One observer, a former U. S. Army aviator, watched the bomb explosions from his hotel roof not half a mile away and then drove out to see the damage. He estimated the hits on the Citroen factory at 80 per cent. Part of the factory burned and the rest was badly shattered. The Air Ministry was severely damaged and the French admitted that 263 of the 906 casualties were military personnel.

There were 254 deaths from this raid and this number might have been much larger if the Germans had not made one mistake in their calculations. The raid began shortly after one o'clock, evidently with the intention of catching the French just after they came back from lunch. The French, however, had the habit of taking two hours for lunch, even in wartime, and this fact undoubtedly cut down the casualties considerably. (It probably saved my own neck, for I had left the Air Ministry at noon, with a return appointment to see a French air force captain right after his lunch—at two o'clock.)

The French claimed to have shot down 17 of the raiding bombers, but still the Germans had demonstrated that they could bomb an objective in the center of a city that believed itself adequately protected from aerial attack. The results were everything that the Germans could have hoped for the French moved their government out of Paris and declared it an open city, thus making a costly and extended siege unnecessary. And once the government had

(Continued on page **81***)*

HAWKS' NEST

PHOTOS BY CURTISS-WRIGHT.

These P-40's now are rolling off the Curtiss production line in a steady stream. The Curtiss company has a record order for $14,000,000 worth of these high-speed fighters.

SCENES like those on this page portray the salvation of Uncle Sam's air defenses. They show that this country can and will produce the world's finest warplanes faster than any other nation on earth. Although all actual production figures in connection with the Curtiss P-40 are strict military secrets, official sources admit that these fighters are coming off the assembly line at the rate of "several per day." There is a dangerous delay, however, due to slow engine production.

The P-40 is a development of the P-36, currently in use by the U. S. Army Air Corps. While the P-36 is equipped with a 950 h.p. air-cooled engine, the P-40 uses a 1,200 h.p. liquid-cooled Allison, greatly enhancing the performance of the P-36. Though no performance figures are available on the P-40, the ship is considerably faster than the P-36, which has a top speed of approximately 310 m.p.h. Of particular interest in connection with the Army's $14,000,000 order for P-40's is the fact that the Air Corps has tripled the ship's original armament, unquestionably as the result of French experience with the P-36 in the current war. There is little doubt but what the P-40 is far superior to either the latest British or German fighters now in action for performance and maneuverability.

The war in Europe has taught the Air Corps the value of concentrated armament. Technician is loading two of six machine guns on P-40. Army planes formerly used two guns.

Curtiss production line below shows rows of P-40's nearing completion. This is closest approach made to mass production of first-line fighters in U. S.

During the past two years the Curtiss plant at Buffalo, N. Y., has been expanded 33 per cent to handle huge orders from U. S. Government and British Purchasing Commission.

PILOTS NEEDED!

by MALDEN G. BISHOP

America must have at least 100,000 flyers to man an air force of 50,000 planes. How can they be trained economically?

Randolph Field plans to give basic training to 4,500 pilots annually. Training of the student climbing into North American BT-9 costs U.S. $15,000.

U. S. ARMY

THE bottleneck in our aerial defense situation is pilot power. Fifty thousand airplanes a year is simple for American industry. One automobile manufacturer has declared that his mighty plant can turn out 1,000 a day under mass production conditions. Every airplane factory in the United States is ready to swing into mass production schedules at the "go" signal from the Government. But one plane or a billion planes are of less use than a bicycle without trained pilots to fly them. The problem is mass production of pilot power to match mass production of airpower.

There is an unknown number of people in the United States who *can* fly an airplane. Counting those now licensed and registered, those who have learned to fly at some time or the other yet have let their licenses expire, students who have learned to fly but are still taking instructions and our Army and Navy pilots, there are an estimated 110,000—a guess at the widest possible number of pilots—good, bad and indifferent. If all these were instantly converted into warplane pilots, we have a one-year supply of pilot power. About 10 days' work for that automobile factory.

It costs the Government about $15,000 to train a single Army or Navy pilot. If the Government could turn out 1,000 pilots a month, it would take nearly five years and cost $750,000,000 to develop 50,000 new pilots.

On June 15, 1940, the Civil Aeronautics Board began another pilot training program for *civilians*. Last year the C.A.B. trained 10,000 on a budget of $4,000,000. This summer it expects to train 15,000 and somewhere between 50,000 and 100,000 in the next year. Most of these, it hopes, will be soloing for the first time. The rest will be taking advanced training and refresher courses. The C.A.B. expects to have $35,000,000 for this work. To participate in this program a student must be enrolled at an accredited and participating college or university or must have already completed at least two years of college and be ready to enroll again, be between 18 and 26 years old and in sound physical condition. As soon as the college enrolls the student the C.A.B. lays down $50 to cover his physical examination, insurance and the cost of classroom instruction in meteorology, aerial navigation, air traffic rules and regulations.

While the college gives the classroom instructions, an approved private flying school gives the student not less than 35 hours' flying experience, not more than 50 hours. For this the C.A.B. pays the flying school $325 in various amounts as the student completes stages of the training work—a total cost of $375 a student to the taxpayers. The C.A.B. makes it clear that theirs is purely a *civilian* pilot training program. The student is not asked nor encouraged to join any reserve unit of the armed forces. If the Army and Navy gets the fledgling they must wait for him to apply voluntarily or they must conscript him. They must *still* add military training to his experience.

In addition to these there are probably 500 students who haven't a college enrollment who are taking flying instruction from private schools or private instructors. They are paying from their own pockets amounts from a few dollars for a few minutes to $4,000 for a complete commercial pilot course.

With a single plant capable of turning out 1,000 planes a day, it alone can produce 365,000 airplanes in a year. The Army, Navy, C.A.B. and private schools combined cannot possibly produce the pilots under present and proposed plans.

Time is a precious element in our aerial defenses. Time may decide victory or defeat for all democracy.

Almost as vital is cost. At $15,000 a pilot we cannot possibly afford to train all the pilots we need. Each dollar saved in training work means another dollar for combat work.

Already Germany has exploded three time-honored ideas about pilot training. First, she has shown that pilots *can* be trained cheaply. Second, that long periods of training are not necessary. Third, that expensive equipment for training is useless waste. During the period when Germany was not allowed to have military planes and was not permitted to train military pilots, she trained some 60,000 pilots in gliders at a cost of $12 per year a pilot! The first fundamental training for a pilot, she reasoned wisely, is learning to manage his plane with rudder, aileron and flippers—to acquire a feel of a plane in the air, a sense of control. A motorless plane does all that. Why waste equipment, motors, gasoline, money for that part of the training?

How many pilots Germany has in store no one knows. It has been estimated that she has at least 100,000 trained pilots. It is known that many of the pilots who are now raining death and destruction, who have been swaying the balance of the war in Hitler's favor, have *less than 50 hours' flying experience.*

During World War I aerial combat was mainly a matter of man-and-plane versus man-and-plane. Today the power of aerial combat comes in numbers. Bombing, scouting, observation and pursuit planes operate in large squadrons. Each group is under the command of an experienced, expert pilot-commander who controls the entire squadron by radio. Except in pursuit squadrons where formations break up in attacking enemy formations, only the pilot-commanders need to be experts. The other pilots do not have to navigate their courses, to select their targets, to time their fire, to decide their maneuvers. All they have to do is to keep their planes in formation and fly as instructed, to drop their bombs when told to release them, to trip their guns when ordered.

Most of our Army and Navy training planes cost from $20,000 up. Into these

Not only is Army and Navy pilot training expensive, but planes like this BT-9, from cockpit of which instructor lectures four students, cost from $35,000 up.

U. S. ARMY

Lightplanes, like these Aeronca "Chiefs," could be used in an expanded pilot training program to give fledgling Army and Navy flyers primary training, similar to C.A.B. plan.

planes go the raw recruits for their first flight training. If they make a mistake $20,000 is lost. The planes in which the pilots are given their advanced training cost from $35,000 to $300,000. The idea behind the Army and Navy training programs is to make every pilot an *expert* pilot. That is the why of the expensive equipment and long period of training time.

If we are to provide mass pilots for our mass production of airplanes, training programs must be thrown open and extended to reach masses of potential pilot power. The C.A.B. program hinges around college educations. It is granted that college students probably will make better pilots and are theoretically better expert pilot material. Still a great number of our most famous and most expert pilots never saw a college enrollment blank. Brawn and brain and guts are required in a good pilot. These may be found in colleges and universities or they may be found in Hickville or the Ozarks. Should national defense swing on the pin of college training? A pilot's ability to maneuver his craft above an enemy objective and deposit a load of bombs, his skill in looking through a ring sight and tripping his guns have little relation to his semester hours of Greek, Latin or history. It's the bombs which are dropped, the guns which are fired, that makes for military victory and not the social and civil qualifications of the man behind the trigger or bomb release toggle.

Little noticed by the general public and even held in contempt by many air enthusiasts is the flea-sized airplane which putt-putts around airports and cow pastures. But they have every first training advantage of any airplane made. The lightplane may well be the answer to America's mass pilot training problems. They are the ultra-simplicity of aircraft. They are easy to fly and as near foolproof as possible. They putt-putt along at 90 m. p. h. They land at 30 m. p. h. or less, too slow and easy to hurt anyone.

The largest lightplane manufacturer is making 300 of them a month. The next largest has just moved into a new factory and is making almost that many. They say they are ready to make 5,000 a year if the Government wants them. In all there are about a dozen factories making lightplanes. These planes retail from $3,000 to less than $1,000. Ford has said that his mass production plans will build planes for one-eighth the present cost. They'll give a pilot an hour's training for three to five gallons of gasoline. Most present training planes use from 20 to 70 gallons an hour. With the mechanization of the armed forces demanding more and more gasoline, conservation of fuel in training is an important factor.

Alfred Bennett

One plan to crack open the bottleneck and make flying instructions available to any who can pass the physical examination already has been advanced. Alfred Bennett, who quit insurance and finance to start his own flying school at Hightstown, N. J., has advanced the plan. Bennett's idea is to have the Government issue two $50 certificates to any one passing the physical examination. The first $50 is cashable when the student solos after about eight hours instructions. When he completes his twentieth hour in the air, the second certificate is cashable. This would cost the Government $5 an hour and would give 20 hours of instruction to 100,000 pilots for as little as $10,000,000 a year—or 700 000 pilots could be trained for the price of the recently launched battleship U.S.S. North Carolina. Bennett's plan is for civilian type of training. Admittedly $5 per hour will not cover the full cost of training, but it is thought that students will find ways of making up the difference from their own pockets.

But whether it is the Bennett Plan, the C.A.B. program or the Army and Navy system, America's planes are without pilots. And coordination of present facilities *plus broad extensions* must become The American Plan. By instituting in the C.A.B. program and in private schools a definite phase of military instruction, months can be lopped off the Army and Navy training

(*Continued on page* 88)

Tulsa's airport is site of a private school. It and other municipal fields could handle total of 15,000 pilots a month for Army, Navy.

BRITAIN'S LATEST

This Grumman fighter, first of many for the British, gets 350 m.p.h. from its 1,200 h.p. engine. Ceiling is 37,000 feet.

"PHOTO BY GROENHOFF"

BY E. JAY DOHERTY

A one-man propaganda campaign for gliders died when its author became more interested in his photos than his words. You've seen his pictures, now meet the man behind the lens.

Groenhoff and his camera are flying partners.

Seeker of pictorial angles, Groenhoff took this picture of a Grumman G-21.

IT was the day after the hurricane of 1938 had raged up the East Coast and left the country from New York to Maine a shambles when Hans Groenhoff, on assignment for an aviation magazine, became one of the few men ever to land on and take-off from a land airport in a seaplane. He was scouting the Long Island Sound for pictures of the destruction when he noticed the Flushing, Long Island, airport was under water. His pilot set the plane down long enough to get a few pictures and they took off on more business.

That is only one of a long line of odd incidents in the life of Hans Groenhoff who makes his living by taking pictures of aviation subjects. He has frozen fingers, contracted influenza and suffered many cases of the jitters in pursuit of pictures that are beautiful or startling or exciting or new. He has "commanded" a squadron of P-36's, has ridden in the bombardier's seat of Army bombers, has taken the air in a *Flying Fortress*. He has hung on struts, dangled from plane doors and scorned safety belts in wildly maneuvered planes.

You have seen the results of his excursions. Six of the recent front covers of FLYING AND POPULAR AVIATION were made by Groenhoff as well as innumerable photos illustrating articles. *Colliers* frequently calls on Groenhoff to illustrate its aviation articles. And they are so pleased with his work that they sometimes assign him to make pictures of non-aviation subjects. If you don't read *Colliers*, you've seen his illustrations in *Fortune* or *American Magazine, The Saturday Evening Post, Parents' Magazine, Coronet, Time* or other publications.

It all started this way: Hans was born near Hamburg, Germany, but he spent most of his boyhood in a small town on the outskirts of Frankfurt-am-Main, a center of gliding activity during the 1920's. He was bitten by the flying bug and learned to pilot a glider before he could shave. His older brother Günther, a well-known glider and transport pilot by the time he was 18, spurred Hans on. He had been a soaring pioneer and he communicated his love for the air to Hans. Günther was killed in Germany while taking-off in a glider. He was only 24.

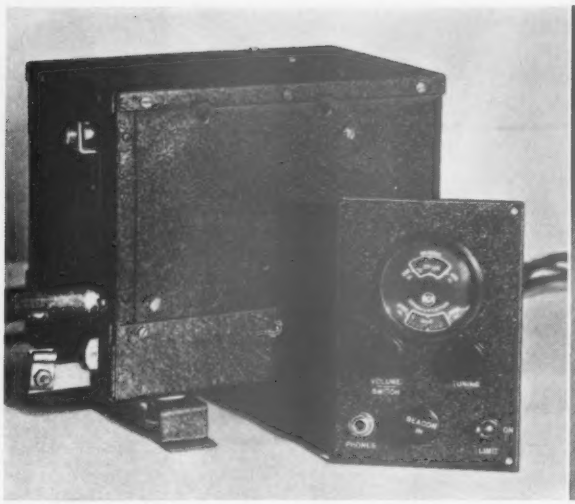
Hans attended law school in Germany. But there seemed no future for lawyers in that country and he emigrated to the United States in 1927, penniless and ignorant of the language. His classical studies got him a job appropriately enough, in a Greek restaurant washing dishes. He eventually was promoted to soda fountain clerk and when he had learned to speak English perfectly, he took a job in an office where his knowledge of law was useful. Groenhoff is now a naturalized citizen and although a trace of accent remains in his speech, he is as American as a Model T Ford.

In America Groenhoff discovered that gliding was almost unheard of so he set out on a one-man crusade to popularize the sport. His first step was the writing of an article, which he illustrated himself and sold to *Esquire*, called "Man into Bird." He kept writing about gliding and sold other articles here and in Germany. The illustrations for his stories interested him more than the writing so he experimented with selling pictures without having to build stories about them and found it would be the ideal way to combine his delight in aviation with a livelihood. He furnished the bathroom with a red bulb and tools from the five and dime store. He spent every minute away from the office making pictures and all his nights developing them and studying photography. He began to sell regularly to magazines, gravure sections of Sunday newspapers and airplane manufacturers who used the pictures in their advertisements. He has sold pictures at prices from 50 cents to $100.

Dressed in his green-checked sports suit, miniature camera slung over one

(*Continued on page* 66)

Dangling from a cockpit or sprawled upon the ground, he has one idea—the picture.



Built for the private flyer by R.C.A., this receiver operates from the plane's battery and weighs only 16 pounds 10 ounces.

If machine-made static is not too bothersome, a portable receiver and transmitter may be used without bonding and shielding plane.

Radio For Your Lightplane

The author's radio-equipped Luscombe gives him the aid of that capable co-pilot, the man in the tower, at busy airports.

Portable radio, which Taylor is checking in a "Cub," enables pilot to get weather reports before take-off, beams in flight.

by MOULTON TAYLOR

Increased airport traffic demands receivers for private airplanes, but you need not spend too much nor add great weight in equipment.

Moulton Taylor has been interested in all forms of radio and in flying since he was a high school student. He now heads Taylor Airphone Products, Long Beach, Calif. He was born in Portland, Ore., in 1912.

He soloed in 1928. Since then he has logged 3,500 hours in practically all types of airplanes. He holds a commercial license in several weight classes and with instrument rating.

After graduating from the University of Washington in 1934 he went to Pensacola, Fla., and received the U. S. Navy advanced flying course. From 1935 until 1939 he was a reserve officer on active duty with the Navy.

Three years ago he began to develop radio equipment for lightplanes as a "sideline" after serving as communications officer with several Navy squadrons and getting wide experience in the aircraft radio field. Since leaving the Navy he has devoted all his time to developing his own laboratory and factory.

He is married, lives in Long Beach and owns a Luscombe "65" equipped for blind flying. It contains two-way radio similar to those in his article.

AMERICA'S heavy-traffic airports are demanding aircraft receiving sets as regular equipment for all pilots using the ports as operations bases. Rapidly increasing traffic and resultant confusion on these fields, where harassed control tower men have been unable to talk to pilots on the ground and in the air, has caused this forward step. On congested fields where radio control of traffic has not been established accidents have become more and more frequent.

In many cases small operators and private pilots are taking the news that they must buy radio receiving sets the hard way. Their attitude is easily understood. The author has a great deal of sympathy for any man who is told that he must spend money for this equipment or move elsewhere with his airplane. He feels exactly like a man being evicted from the old homestead by the sheriff.

There is considerable beefing. The private flyer and the small operator charge that they are being discriminated against. They claim that the airlines are being favored. They claim that until the Podunk and Oshkosh Airlines began to fly into the field everybody was getting along swell —just one big, happy family. Now they are being forced out. This is because in

An under-fuselage antenna has been installed on this Aeronca for its Lear receiver. It also has a transmitter and direction finder. The installation has C.A.B. approval.

every instance to date, as far as can be determined, radio receiving sets are being made compulsory on fields from which airlines operate.

But it isn't discrimination. Far from it. It's progress. Airlines or no airlines, traffic is getting heavier and heavier. Furthermore, *not* airlines but private flyers and commercial operators have been involved in crashes on the ground or in the air near flying fields in recent months. This "we've been driven off the field by vested interests" contention is swell as a prop for an argument. But the argument doesn't stand up. And the man who is operating from a congested field today and who fights against radio installation is just as much a reactionary as the fellow who thinks aviation is a passing fancy.

It's tough to have to buy radio equipment. On the other hand, radio has to be. There will be more and more airplanes all the time. And, when you consider the man in the tower and his control over your destiny—he is in a position to have none of the blind spots which afflict you and can advise you—radio is excellent insurance.

Before going into a discussion of price, weights and generally practicability of lightplane radio, let's run over the list of advantages it has. First of all it gives you that very capable co-pilot, the man in the tower. He knows what is above you, below you and behind you. He tells you about it and he tells you the direction and speed of the wind on the ground, what runway to use. That's pretty good in itself. Toss in the fact that when you start out he tells you when to taxi, when to take-off, and what runway to use and he is practically invaluable.

But let's go farther. With radio you can get advance weather before you take-off. You can listen to a broadcast on winds aloft and discover at what elevation tail winds will help you make your best time and save you gasoline and wear and tear. You can learn weather at your destination, cancelling your flight or altering your course to conform. Once in the air, you can fly the shortest distance between two points—the beam. And you can get weather changes en route. Radio gives you safety, economy and speed.

What of the cost to gain these things? The progress which has been made within the last year or two probably will amaze you. It is possible to have radio receiving equipment in your ship for about $37.50! Consider the fact that you think nothing of spending $50 or so for a radio which does nothing more than entertain you when you buy a car. Aren't safety and economy worth less than that much to you as you fly a $2,000 airplane?

You'll need an overhead antenna. Installations can be had for as low as $2.50 but you can pay as high as $10. You can get a portable set capable of receiving both standard wave lengths for your entertainment and beams and weather for safety, economy and peace of mind for $30. You can pay as high as $50, but let us consider only base figures. Last expense will be for earphones. Standard phones of good quality can be had for $5. There's your total—$37.50.

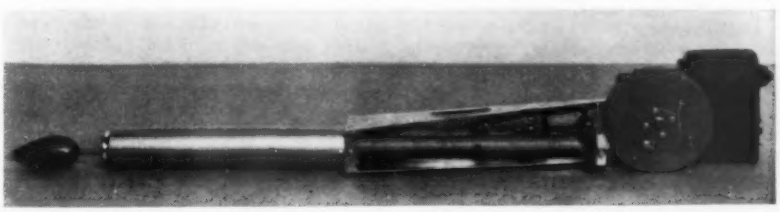
Of course, this is not ideal reception. The big trouble is machine-made static. The set picks up and broadcasts into your ears those electric impulses from the magneto or, in the case of dual ignition, magnetos. Sometimes you'll get a ship where the interference is not great. Perhaps too, your ears don't "worry" about such noises. In either case you'll get the beam, control tower and weather through this relentless tick-tack and do reasonably well.

On the other hand you may be the type of person who'll be driven slightly mad by the constant interference. And you may have a motor which is picked up very loudly by your receiver. This means the additional expense of bonding and shielding.

Bonding is a very simple operation. The motor mount is connected to the fuselage by a mesh wire establishing the bond broken by your rubber engine vigration cushions. While some radio men have contended that this is not enough, it has been the author's experience with lightplanes that elaborate bonding of control surfaces, brakes, lights and what-not is entirely unnecessary. You can do the bonding yourself in one easy operation. Shielding is more complex and more expensive. If you buy the parts, you can do the job yourself for about $25 providing you use re-conditioned shielded spark plugs. These plugs function satisfactorily. New shielded plugs cost quite a bit more especially when you have dual ignition which calls for eight plugs in standard four-cylinder lightplane engines. In addition to this installation, it is necessary to shield the ignition switch, run shielded wire from magnetos to spark plugs and shield the switch wires. If you do the work yourself, your bill for radio will run $62.50. If you call in an electrician to do the job, your bill including materials may run as high as $75, pushing your total up to $112.50.

With your ship properly shielded and bonded, antenna installed and radio and earphones purchased, the job is done. The only operating expense you will have will be the purchase of about four sets of dry batteries a year at around $3 per set or $12 a year.

So far we've considered only the portable sets. This type has a couple of disadvantages. No matter where you put it you're going to have to do some reaching around to tune into control stations and beams. And it's bulky. It takes up room. On the other hand, it has advantages. It may be removed from the ship with ease—simply by removing the ground and aerial wires—and can be taken home. You can use it there or anywhere else for entertainment. The modern portable has exceptional tone quality. Next morning if you want the weather before you leave the house, turn a dial and you have it. And you can add this equipment to your plane without cutting down your payload. If you sell your airplane and want to keep your radio, you can do so without leaving an ugly hole in the dashboard.



Transmitting is done by trailing antenna. Lear type shown is reeled in for landing.

Piper "Cub Coupes" ordered by the C.A.B. for use of its inspectors are equipped with overhead trailing antenna for transmitting and fixed vertical antenna for receiver.

The weight of your portable will be about 13½ pounds. It will be made lighter in time, less bulky, more efficient, easier to handle. If properly installed it will receive the beam clearly for at least 75 miles. As beam stations are in all cases less than 150 miles from each other on all airways you'll always get the beam. If you are within 75 miles of a weather broadcasting station you'll be able to get reports clearly. And you should be able to pick up any radio control tower within 25 miles. This is more than enough for, naturally, you won't be hearing from the tower man until you are within his vision.

Should you decide you want a permanent installation with a dial on your dashboard, you'll pay from $50 to $175 for the set in addition to the antenna, earphone and bonding and shielding expense. It'll be right there on the dash easy to see with the knobs well within reach and easy to handle. An expert will install it, which means that it will be operating at peak of efficiency. As it is designed for airplane use only it will be of better construction due to the higher standards required of equipment for permanent installation. Among the other features incorporated in it will be that the tower frequency is already tuned in. You'll have better selectivity and far better range. All of which you'll pay for. If you've gone this far, you will have spent in the neighborhood of from $125 to $200 and you'll have just about the tops in lightplane reception.

Now that your bill is up this high—perhaps you are just dreaming of an airplane you'll own soon and aren't a private flyer or an operator who has to spend $75 or so to be able to stay on a field—let's consider some cheerful developments. One is that lightplane manufacturers are already aware of the growing traffic problem and are already considering bonding and shielding as standard equipment. When this step is taken your radio will cost you a total of $37.50 with nearly perfect reception. And that isn't all. One of the lightplane companies is now considering going one step farther and offering radio receiving equipment as standard. Both these developments are of advantage to you and at the same time prove the point that while radio is a financial hardship to some and undeniably clutters this business of flying with more gadgets, it is inevitable from every angle. Its advantages outweigh its disadvantages and lightplane builders are coming to realize it.

Listening to the control tower, the beam and the weather man is educational. But with just a receiving set you can't talk back. You're mute. For instance let's say that you've just approached a radio-controlled field with your volume too strong, making the tower man sound as if he had a hot potato in his mouth. Having no way to ask him to repeat all you can do is guess what he said and guessing under such circumstances can develop into a fatal pastime. Or perhaps you are unfamiliar with the field and want special information. You can't get it.

Acquiring a voice won't mean a lot of expense. You will need a new antenna to operate your transmitter. There are two types. If you want the trailing type antenna with a weight on the end, you have to reel it in on landing which means that you have to switch over to another shorter antenna to transmit while on the ground. The shorter antenna will now be overhead where the receiving antenna used to be. This means moving the receiving antenna to the bottom of the plane. To make the changeover and provide the reel for the trailing antenna set aside about $25.

The second type is an overhead trailing arrangement. This, when reeled in, runs from the fin to the fitting over the cabin and acts as a short fixed antenna for transmitting on the ground. As you unreel in flight a midget wind cone pulls the antenna straight out behind through a channel on top of the fin. This antenna can be used for both air and ground transmission, as explained, and also for reception if you want to arrange a switch to change the antenna from the receiver to the transmitter or if the equipment you buy has a relay which does this when you operate the transmitter. However the lightweight equipment now available is most satisfactory when separate antennas are used for receiver and transmitter, eliminating relays and switches. The cost of this type of antenna is also about $25.

Now available, and of considerable interest to lightplane owners, is a portable transmitter and receiver combination. This equipment, weighing only 13½ pounds, the same as the portable receiver alone, will cost you $150. Figuring antenna, bonding and shielding, your entire investment will be about $200 providing you do the bonding and shielding yourself. Receiving performance will be the same as that given for the receiver alone. Transmission range of 35 miles when the ship is in the air is guaranteed. Distances of from 60 to 100 miles under favorable conditions are not unusual. The entire set is operated on dry cells and it is complete in itself. Battery life, however, is only about a third as long as in the case of the portable receiver alone, providing you use the transmitter frequently. The power is ½ watt. If you jump it to one watt, the weight of the portable will hop up to 16 pounds by additional batteries. On this set, first of its kind, the necessity of antenna changeover relay is eliminated, a feature found heretofore only on high-priced sets. This makes the only antenna operated by the midget wind cone sufficient for both receiving and transmitting.

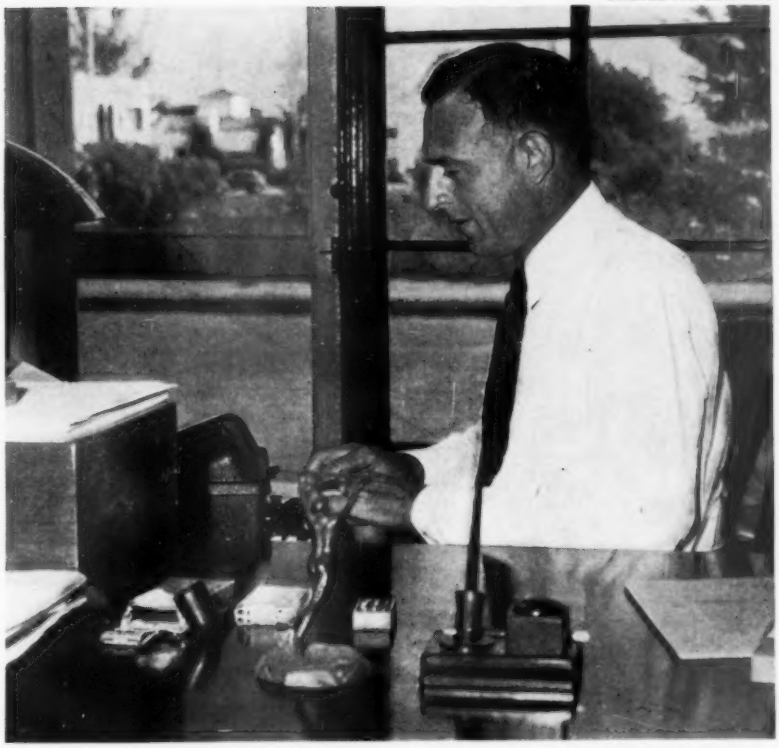
If you prefer to keep your portable receiver, which you've acquired at a cost of $37.50 without bonding and shielding, you can get a separate portable transmitter for $75. If you aren't satisfied with the combinations offered above for your lightplane and really want to spend money, you can go as high as $350 for various types of installations. If you want a permanent receiver-transmitter installation, the price will be the same as for the portable—$150. You might not be satisfied to discuss your problems with the control tower at a limited 35 miles. You might want to raise the ante to 75 or 100 miles. To do so you'd have to use wet batteries which would add to both weight and cost. And you'd have to have a power unit which would add again to weight and cost. This would mean $100 or more for your transmitter, instead of $75. The weight would be increased about four pounds. Your power unit, costing $25, would add from four to 15 pounds. And then you'd spend from $15 to $50 for a generator and add another four to eight pounds. You'd also drop a couple of miles of cruising speed turning the generator. Sooner or later some flying radio "ham" is going to combine equipment and ship to the point where he won't be able to get off the ground. But let's not worry about that.

While on the subject of weight and drag, it might be well to point out that antenna drag is negligible. Obviously in facing the problem of equipping the lightplane with radio we have three factors which must be whipped and which we are whipping—cost of equipment and installation, weight and drag, hindered performance. The reason for the recent amazing development in lightplane radio is the dry battery. True the range isn't as great as with wet cells. But you don't have to fool with heavy equipment, acids, power units and generators. Several big companies are bringing out dry cells which are compact, weigh far less than the wet type and have extremely long life. The dry battery is the logical solution to the lightplane radio problem which confronts us.

Not long ago we were selling six and 12-volt wet battery models. They were not satisfactory for lightplanes. Generators had to be installed. The capacity of the average wet cell aircraft battery is only 13 to 21 ampere hours and this is not sufficient

(*Continued on page* 89)

GERECKE-PAN AMERICAN



An air rescue story about Louisville's January, 1937, flood was Jamieson's entree to "The Saturday Evening Post" after 10 years of trying. He writes in his Miami office.

AIRMAN-JOURNALIST

by JACK STARK

Flying is Leland Jamieson's vocation, but his aviation stories, written as a hobby, have brought him world fame as a writer

IT'S 7:30 p.m. by Miami's north section clocks. A big red and green tipped airliner throbs overhead. In the shadowed nose a tall, raw-boned "big guy" of aviation and fiction streaks through the night towards Jacksonville—and new plots.

It's Oklahoma's "word-buster," Leland Jamieson, settled comfortably behind the dials and instruments of an Eastern Air Lines' Douglas DC-3. The 21 passengers behind the cockpit door ride through the night blissfully unaware their trip may prove the basis for another stirring aviation story for the Errol Flynn-sized pilot who strode up the cabin aisle a few moments before.

Don't let Jamieson's dual activities confuse you. For the author and pilot is a likeable, easy-going fellow who just happens to be blessed with the rare gift of fiction gab—plus a good set of reflexes which make for a good pilot. He combines both professions without any delusions of grandeur.

It isn't known if his story writing helps his flying, but readers know his flying helps his stories. Leland Jamieson has found relaxation in struggling up to the top rung of literary success. His knowledge of flying, the viewpoint of an airline and former Army pilot, all have been filtered into his writing.

Leland Jamieson sits there in his writing sanctum—an office in a two-story building in downtown Coral Gables—with one leg cocked over the arm of his swivel chair. He wears a loose sport shirt, plain brown shoes and blue slack pants. To his right at one corner of a plain office desk is an electric typewriter which he hunches up to now and then to make notes. There are no rugs on the tiled floor, no pictures on the wall—only a large map and an Eastern Air Lines calendar. He's a bear for work this fellow who lives in a white Spanish-type mansion in Coral Gables with the pretty Mrs. Jamieson, a daughter, Sandra, and a small son, Leland, Jr. Besides flying 20 hours a week on the night run between Miami and Jacksonville for EAL, he trots down daytimes to this office to bang out more fiction. Flying five nights on the 300-mile run and laying off five nights, Jamieson doesn't know himself how many hours he spends writing each week. He freely admits he puts in all his spare time at it and his co-pilots—those who used to fly the New York route with him—can tell you how Leland often lugged a portable typewriter along with him so he could click away at stories during layovers.

The fellow just hasn't any illusions as to his importance. "Writing is work and flying is work," he says. "I worked 10 years to get in *The Saturday Evening Post*. Now for the next 10 I am going to try to stay there."

Only 36 today Leland Jamieson claims he will fly as long as he can lift himself into a cockpit, a medical examiner doesn't "get him" and he continues to stay hired. And the Eastern Air family is proud of its noted son. Shop grease monkeys have warmed up to him ever since he wrote "Maintenance" for the *Post*, a story of the work and struggles of airline mechanics. Leland could spend hours with you talking about airline mechanics whom he terms the "backbone of the industry."

His co-pilots are always trying to get back on his run because Jamieson not only is a swell cockpit pal, but he watches their progress with two eyes although they never sense it. He nearly bites his lip off time and again when a co-pilot does something wrong, but he lets the man feel the mistake out himself. He likes the co-pilot who cusses himself out after making a mistake instead of the kind that gets grimly determined and sets his mouth in a hard line of righteousness.

"I've gotten a story from every co-pilot I have ridden with," said Jamieson. "I talk to them, feel them out and from their lives I always get a good story."

Eastern Air Lines in 1939 awarded the amazed flier a gold medal for his extra-curricular fame as the pilot who had made the most outstanding contribution to aviation during the year. Jamieson keeps it hidden in a safe and it almost takes an act of Congress to make him drag it out.

As he is quick in action and straight to the point—with a good bit of humor thrown in for good measure—so Leland Jamieson sums up his early life in a single paragraph. From it you can find the basis for his many stories. This is the way he puts it:

"Since I was 15 I have worked more or less seriously at being a rodman on a surveyor's gang, a mule skinner, an insurance salesman and a music store clerk; have frittered away a few years in college, managed (and mismanaged) a dance orchestra in which I played trumpet very badly, learned to fly at the Air Corps schools in San Antonio (1925) and held a second lieutenancy in the Army Air Corps on active duty for the following three years."

For his latest serial (above) Jamieson talked to Naval officers, studied tactics, then went to work (right) to plot accurate action on map.

GERECKE-PAN AMERICAN

There is more to it than that though. A story of hard work in aviation's early days, a hectic, misdirected school career and of Army flying when America narrowly escaped losing its popular writer of air fiction.

Born in Oklahoma, then Indian Territory, in 1904, Jamieson grew up in the small college town of Edmond where his father was a professor of English by day and a dairy farmer mornings and evenings. Like most sons of scholars he was no scholar. He entered Central State Teachers College and then went to Oklahoma University for a year to specialize in music. He drummed through college haphazardly, still studying music, and later organized the dance band which brought him neither fame as an organizer nor halos as a leader.

In 1923 the gangling Leland wandered around Oklahoma City airfield buying time in an OX Canuck for $15 an hour. It kept him broke. Although he had the desire to fly and walked around with his head in the clouds, he was never able to raise enough money to solo. In 1925 the Army let him in. He obtained an appointment to Brooks Field, San Antonio, Texas, and was "set for life." He was no blazing comet across the Army Air Corps skies. But he acquired the flying knowledge that today strongly marks his fiction and his commercial air route piloting. He was commissioned a second lieutenant in 1926 and was sent to Kelly Field to instruct with only a few hundred hours under his belt. Jamieson stayed at Kelly Field until 1929, using his spare time on the ground for writing air stories which had a habit of coming back to him more often than they stayed put.

"Jamieson's a damn fool" was the most popular remark his buddies passed around among themselves at Kelly Field. Gathered in the officers' club playing pool, cards and relaxing Army style after hours of flying, they couldn't understand why Jamieson sat hunched over a typewriter most of the time when he could have been having fun. If his stories had clicked steadily they might have excused him. As it was they just shook their heads. In 1929 Jamieson left Army flying for good. He says:

"After about two years of selling spare-time fiction to the pulps, I had had enough of the Army—due in part to my belief that I could make a living writing, but mainly to an undiagnosed case of carbon monoxide poisoning from the open exhaust stacks of the Army planes I was flying several hours each day. I was sick most of the time and light-headed and faint every time I stayed more than an hour or two in the air. Every doctor I went to told me nothing was wrong with me, but I knew there was; and I knew that sooner or later I was going to pass out in the air.

"So I resigned and for a few weeks did nothing but write. The mysterious illness left me completely and the itch to fly returned. Finally I abandoned the full time fiction job to manage a system of flying schools and I began flying again somewhat skeptically. But in commercial planes with their exhaust collector rings that piped the exhaust gases away from the cockpit I never felt ill again." Today Jamieson has over 10,400 hours!

To get at the base of one of Jamieson's fundamental precepts—that you must prepare yourself for what you want to do—it is necessary to go back to the bonanza period during 1929 when, as he himself puts it, he was "tossed into the madhouse of commercial aviation." He had been out of the Army a few weeks and was making a living from his stories when the telegram from Interstate Airlines came offering him a job as manager of a system of flying schools. Jamieson jumped at it.

"They said," he explains ruefully, "that I would have time to write at least a story a month and do their job too. But in the next two years I wrote only one story." So the writing of fiction was for those two years a lost hobby.

"It was open season on brass-hats," he recalls, grinning. "Now you saw the boss—and now you didn't. I was there six months and my superior was transferred to the East on a new job—and suddenly as operations manager I inherited an air mail line between Chicago, Atlanta and St. Louis. It was one of the worst mistakes of my life to accept that promotion. I was too young—25—and, Army trained, I didn't know how ex-barnstormers' minds worked and I couldn't get along with them. Some of the time I wanted to fire them and most of the time they wanted me fired. A few of the more optimistic ones put up bets on how long I'd be around. Six months was considered a safe estimate. But I fooled them. I stuck around two years before I got mine. One day I got a letter from the boss saying he thought it would be to my benefit and his peace of mind if I'd sever my connection with the company. To persuade me in that direction he said he was stopping my pay."

The next day Jamieson went to work for Eastern Air Transport which had offered him a job some months before. But he was finished with trying to be an executive. He went to work as a pilot, "pushing 'em up and down the line." He started as reserve pilot in Atlanta. With a line job and the spare time that it gave him Jamieson began writing in earnest again. "I woke up," he says, "to realize that there was a good deal about writing that I'd forgotten. I couldn't 'see' stories and I couldn't write them. For three months I fumbled around before I got started again."

He is, he says, still fumbling around. He fumbled through some 60 or 70 published pulp magazine yarns—then, after 10 years of literary sweating, cracked America's largest weekly with an action-packed air rescue story about the Louisville flood. The editors asked for more. They came in frequent succession. The same Kelly Field writing zeal was there, but the success sand glass had been tipped the other way and soon Jamieson was making a name for himself as a writer.

In 1933 the Jamieson clan was saddened by the death of Leland's brother, William Lawrence, killed in a plane crash on an airline route. As a pilot Lawrence had no equal, both Leland and his younger brother,

(*Continued on page* 81)

I Learned About FLYING From That!—No. 18

by WAYNE F. LANSING

Unknowing laborers "reinforced" the floor of a Ford in Honduras with iron and planks. Only a ground loop prevented a serious landing crash.

The author in flying kit.

WE had been flying heavy loads of freight from the capital of Honduras, Tegucigalpa, to the Agua Fria mine. It took 25 minutes and was the only way equipment and material could be transported and the mine made to pay. Agua Fria is an old Spanish mine that long ago was worked by slave labor and abandoned after the Spaniards were driven out of the country. Attempts had been made several times to reopen it, but as there were no roads and only about three months of dry weather, all efforts failed until air service was established.

We were using a Ford 5-AT powered with three Pratt and Whitney *Wasp* C 420 h.p. engines. The cabin was designed so that the whole top swung open on a hinge to facilitate the loading of heavy pieces of mining and other necessary equipment which included everything required to house, clothe and feed the entire personnel. We already had hauled materials for the store, school, hospital, movie theater and water filtering plant. Everything but electricity.

The huge casting for the dynamo of the electric plant weighed 4,480 pounds and I had never carried a heavier load than 4,000 pounds. I thought if I used my head and took off early in the morning when the air was cool and heavy before the sun had a chance to heat it the extra 480 pounds would be duck soup.

I told my crew, consisting of one American mechanic and six native peon laborers, to load the casting in the plane with the portable crane. Then I spent the whole day measuring and figuring just what spot in the cabin to place it in in order to get the most weight near the center of lift. Otherwise the stabilizer might not be able to take care of the excessive load on the tail and pull the plane up in a stall in spite of all the forward pressure I could put on the elevators. I might be able to hold it for a while, but 25 minutes is too long for any pilot no matter how strong he may be to exert all his strength holding the tail up or down. I had had a close call this way before by being careless of weight distribution. As far as that angle goes, I discovered later that the stabilizer will take care of it very nicely.

It took them three days to get it loaded, centered and securely tied down with heavy rope to keep it from shifting around in the air—especially if I should run into some bumps. I waited almost a week, going out to the field every morning at 4:30. Finally the right morning came along. No wind and heavy cool air. I'd better explain why I did not want any wind as no doubt you will bring up the question that a good wind would help me get off. The so-called airport at the capital has only one runway and when the wind *does* blow it's from every possible direction except straight down the runway. Also any wind at the mine field will be downwind, since it is 3,800 feet high and can only be approached from one direction—up a canyon.

I taxied out to the end of the field, using a slightly down-hill take-off, and ran up the motors, checking each one carefully and again going over all the details I could think of. Yes, I had planned everything perfectly, still something was not right. I checked every item again and again in my mind. Have I figured my gasoline right? Yes, the 50 per cent margin of safety would be more than ample as the weather was perfect. No, it can't be that, everything is all right, just a little on edge about the whole affair. So let's go and get it over with, I thought. Had to hurry now anyhow, can't let the sun get up and make the air bumpy.

Stabilizer set, I held the wheel with my left hand, had my right leg around the brake lever locking it to get the motors open as far as possible before letting the plane start to roll. This procedure saved several hundred feet of available runway. The motors all were running perfectly. One last look at instruments and gas switches before releasing the brakes. The plane started to roll, slowly at first. It took much longer than I liked to get the tail up in a take-off position. We were moving too slowly. I had a feeling of panic for a second. Should I cut the master switch and not make the take-off? No, too late for that, I could not get it stopped now before the end of the field. If I could only get rid of the feeling that something was wrong, something had been overlooked. But what? No time to worry about it now, I thought.

We were almost to the end of the field

(*Continued on page* 80)

Two tons of supplies and equipment await loading in an old Ford for the short but difficult flight from Tegucigalpa to Aqua Fria mine where only approach was downwind.

BOEING

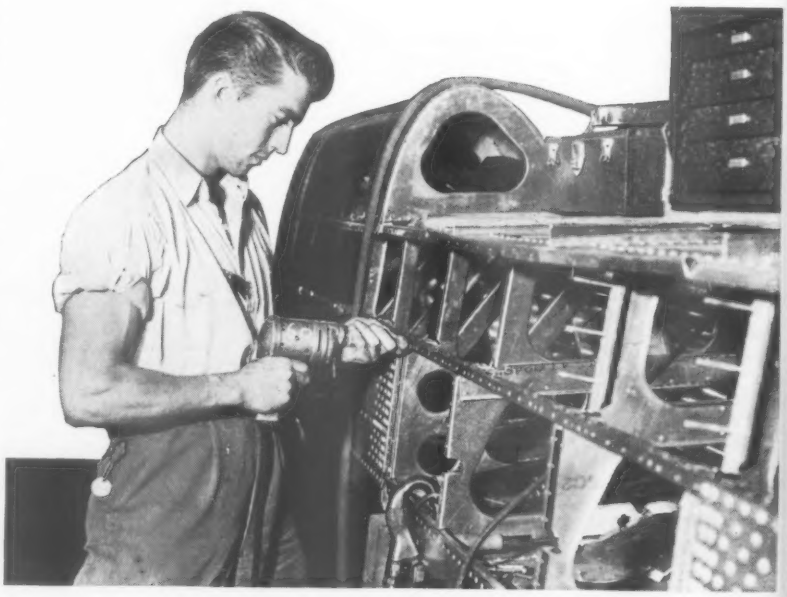
ARE YOU QUALIFIED?

by Hurd Barrett

Engineers, draftsmen and mechanics are badly needed in the aviation industry, but untrained men need not apply.

THIS article was written about six weeks ago, but just as it was ready to slip in the air mail chute down at the post office something happened. The President made a speech to Congress in which he said something about 50,000 airplanes.

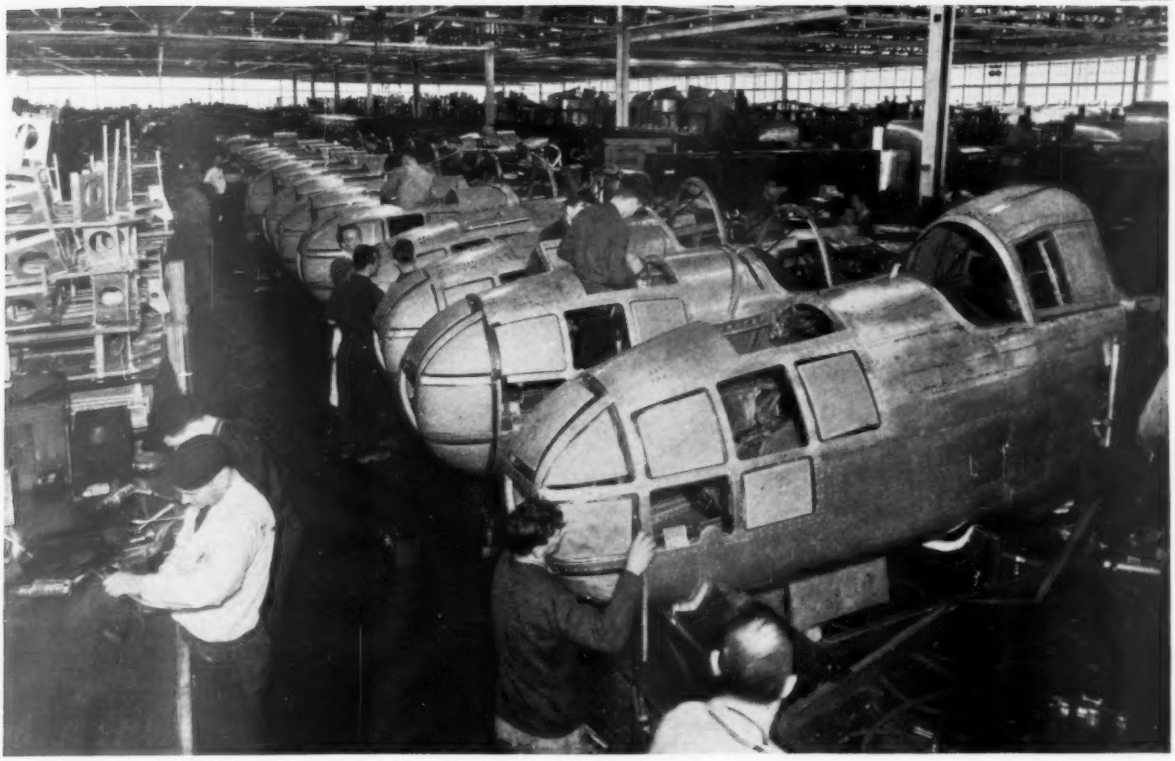
Now 50,000 is a lot of airplanes, and it's going to call for a lot of men to build them. And since the whole premise of this piece is that skill and special training is what it takes for a man to get himself hired into the airplane industry we began to wonder if we hadn't better wait and see what was going to happen before we went on record with the several vehement things we had said about people who tried to get jobs without having any knowledge of or skill in the work they wanted to do. Perhaps, we thought, with 50,000 ships to build the manufacturers will have to start hiring men off the street corners as mechanics and train them as they go along. But, alas, we were right the first time. About the only change in the situation



DOUGLAS

Engineering department draftsmen (top of page) must be experienced and only trained men (right) can run rivet gun.

MARTIN



Many of the 150 distinct types of mechanical jobs are necessary on the assembly line whether plant produces bombers or lightplanes.

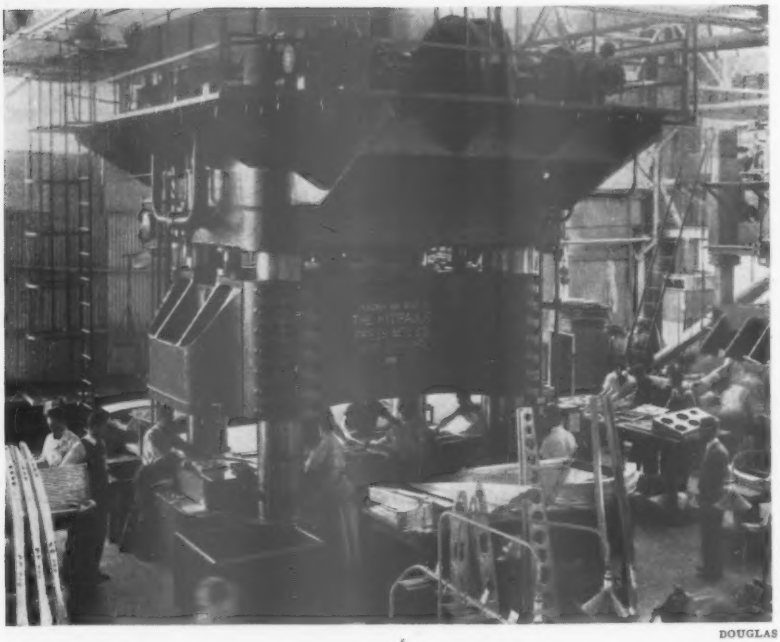
of the unskilled is that the Government will set up schools for airplane mechanics where the chosen few will be able to get special training without paying for it by working it out as apprentices.

The untrained men are still standing outside the aircraft plants and they will be standing there for some time to come. There is no doubt that the aircraft industry is going to know the greatest expansion in its history within the next eight to 12 months and the men who are going to profit by that expansion are the ones who have been willing to fit themselves through study and practice to hold down a job in it.

Of the thousands of applications for work on file in the personnel office of one of the larger manufacturers on the Pacific Coast, almost all were made by young men who had no qualifications whatever for any branch of aircraft work. When we first applied for work at the Douglas Aircraft Company in the early depression years, we were unable to get a job. Douglas did not at the moment need riggers, installation men, line mechanics—nor in fact any of the many kinds of aircraft labor for which we were qualified. They *did* need machinists—even machinists who had never seen an airplane before. They could likewise use pattern makers, toolmakers, cabinet workers, sheet metal men and punch press operators—whether or not *they* had ever seen an airplane before. The jack of all trades was out. He still is. And so are thousands of untrained high school and liberal arts college graduates who today are storming the manufacturers' personnel offices. Aircraft manufacturing, like most other American industries, is the stamping ground of the specialist who can do one class of work very, very well.

The personnel of an aircraft factory fall into three main categories: Clerical, engineering and mechanical. The first of these includes the perhaps 20 per cent of the total who do the paper and petty executive work incident to shipping, receiving, timekeeping, stock keeping, typing, filing, stock chasing and other necessary but nonproductive functions. Practically speaking, this is the only branch of the industry which offers an opening to the untrained man and so far there are no schools outside the industry which give comprehensive courses in, for example, the gentle art of locating 100 microscopic pulley brackets which unaccountably have become lost

Machines, like this mill, need skilled men at controls. There is a shortage of both.



DOUGLAS

Good machinists are made only after two to five years' apprenticeship. Untrained men would slow production, probably cause damage if they were employed on big die presses.

somewhere in the three to 10 square miles of the factory system. Nonetheless, you may be quite sure that the employment manager will, wherever possible, pick his clerical help from among those people who have had business-school training or experience in some other industry which parallels the work they will be expected to do.

Generally speaking, an applicant for clerical work in the aircraft industry will do well to sell himself on the basis of his experience in some other business. Or on the fact that he possesses specialized training in bookkeeping, mathematics, accounting, stenography or business machines operation. Walter Gage, personnel manager of Northrop Aircraft Corporation, said it is his conviction that not one man in the hundreds he interviews weekly has any idea as to what qualifications an employer is interested in. "I feel sorry for them," he said. "And I'd like to give them all jobs. But usually you can't find out what they can do for you. Quite a few of them could sell a second hand jallopy on its merits, but not one in 10 can sell himself."

The second main personnel division—engineering—employs another 20 per cent of the factory's help. Here inexperienced men have little or no chance of landing jobs. Engineering personnel is hired exclusively for the technical education it possesses. In the lower wage brackets they want well-schooled draftsmen who are able to do detail drawings of aircraft components under the supervision of more experienced group leaders. A sound background in mathematics and the theory of mechanics, plus six months to a year of drafting—high school or trade school—ordinarily will serve to qualify a person as a junior draftsman. And from these junior draftsmen the industry develops many of its engineering executives and design men. Further up the scale are the college graduates in aircraft engineering who, with a few years of practical experience, can become the big design men of the industry. A good metallurgist can often find a job on an engineering staff. So can men experienced in other fields of manufacturing or who are skilled in calculating the strength of materials. So can mathematical wizards and industrial designers. At present there is such a shortage of experienced aircraft engineering personnel that several companies have field men scouring other industries for technicians whose skills can be adapted to the design of aircraft.

In the third—mechanical—branch, the trained machinist is always in great demand. There is a shortage of machine tools themselves. No factory in the country today has enough machinery. *Nor do they have enough first rate operators for the machines they have.* Good machinists are made only after an apprenticeship of from two to five years and in the past 10 years we have not been training enough of them to compensate for the normal mortality of mankind. That's skilled labor, the cream of the labor market which earns the top wages in industry. Classed with it are expert gas and arc welders, pattern makers, model makers capable of working in wood to the ten-thousandths of an inch, die makers, drop hammer operators, sheet metal hand formers and loftsmen. Classed with it are master engine mechanics, line mechanics, flight engineers and the check-out inspectors who are responsible for the proper performance of each new ship before the test pilot takes it into the air. This skilled labor constitutes perhaps 10 per cent of the mechanical staff of a factory.

There are something like 150 separate and distinct types of mechanical work in an airplane factory and—more important to a man looking for a job—at least 50 per cent of these jobs require no more than the most rudimentary training to fill. Most Americans with their innate mechanical aptitude could qualify themselves in a short time for some kind of aircraft job. The hitch is that most of them won't.

One of the first requisites for mechanical employment is the ability to read blueprints. Proper blueprint reading requires a knowledge of three-view perspective and the ability to visualize the finished part or assembly in detail. Once given this knowledge of blueprint reading plus a basic mechanical training in the use of tools, there are many other aircraft jobs open to a man of limited mechanical experience. All of us remember the "Erector" and "Mecanno" sets we played with when we were kids. There is really nothing more complicated about the trade of a junior aircraft assembly man or riveter than there is in the building of a toy bridge. He has to know the principles and he has to be able to use certain simple tools. *But*—although any person of normal intelligence and mechanical aptitude can be taught the fundamentals of operating a pneumatic rivet gun, slowly and well, in a few hours, only experience and careful training will enable him to develop the speed and skill he needs to drive the 1,500 or 2,000 rivets a shift his employer will expect of a professional riveter.

Which is why no employer will hire a greenhorn while there are still trained aircraft riveters to be had. Any person who has seen the physical and material damage a runaway high speed extension drill or rivet set can do in the hands of a novice will understand why. Your employer is not interested in running a school for riveters. He is interested in getting a job done.

Which brings us to the old question as to the value of trade schools. Recently we had an article in one of the national magazines on aircraft production. We received some 200 letters. Most of these were from young men and fully 90 per cent of them were requests for information and advice on how to go about finding a job in aviation. The greater part were from people who were absolutely unqualified—either by education or experience—for aircraft factory employment. Most of the latter asked whether or not we thought that:

A. Aviation trade school training would be of any value to them;

B. If it wasn't true that most trade schools were exorbitantly priced "gyps"—who promised employment to their students after graduation and then reneged on their promises.

Answering the first part. To the unskilled or inexperienced man who is looking for a job in the aircraft industry, training by a *reliable* trade school in the trade he means to follow will increase his chances of obtaining employment by the ratio of at least 10 to one. In some cases the training they give him will repay the cost of his tuition many times over by reason of the pay raises and increased opportunities for advancement his specialized knowledge will bring him.

As to the second part of the question: There certainly *are* many "gyp" trade

(*Continued on page* 88)

MULTIPLE STOOGE

by KURT RAND

Engineers are going to know just what Lockheed's XP-38 can do by listening to magnetized steel tape.

A sound engineer checks Planetest Magnograph which will be used in testing new Army pursuit ship. Keyboard at right controls 16 possible sound tracks for recording.

EIGHTEEN HUNDRED feet of quarter-inch steel tape soon will tell engineers and Air Corps observers just what Lockheed's new XP-38 can do. When the twin-engined pursuit ship is put through its paces in its flight test, the latest wrinkle in sound engineering and record ng will ride along with the test pilot. It is the Planetest Magnograph.

Invented by Herman S. Heller, the device is able to record simultaneously on two narrow bands of steel as many as 16 voices or sound vibrations. Fed through a magnetic field at the rate of either 30 or 60 feet a minute—the latter gives better voice reproduction—the tape does not bear scratches, dots or other indentations after use; it remains unmarked. No processing is necessary before listening to or making a transcription of the recording. The tape is played back through the same machine. It may be used any number of times without effect upon the invisible magnetic sound track. Each of the two 1,800-foot tapes contained in the double deck machine can pick up eight separate voice or sound vibrations without garbling or overlapping. The recording is permanent until the tape is passed through a wiping magnet the field of which is strong enough to destroy those induced in the tape by the recording magnets.

For the XP-38 test, the two-deck machine will be used. The test pilot will use one track for his voice recording of instrument readings and other data while another track will record vibration and noise—important in the detection of flutter. No microphone is used to pick up the latter sounds, but the pilot will be equipped with a throat microphone which fits beneath the collar and is held against the outside of the vocal cords. It may be worn with an oxygen mask and accurately reproduces all human voice vibrations except those of the letter "S." When larger ships are tested, a number of flight engineers making the test will be able to record their data at the same time.

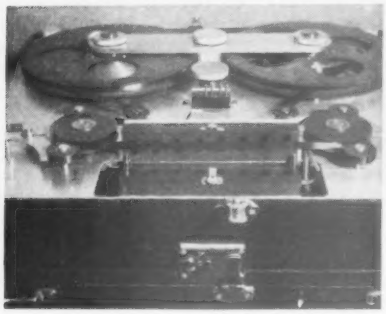
The remote control unit carries a button for each sound track. It is connected to the recording machine by three cables. In both recording and reproducing sounds, either alternating or direct electric current is supplied only to a motor which moves the tape. A speedometer checks the speed at which the tape is fed through the magnetic recorders so that it will be played back at the same speed. At 30 feet a minute, the machine will run for an hour, producing 16 separate sound tracks. If a single sound track is used, the machine can operate 16 hours. At 60 feet a minute, 16 half-hour recordings or a single eight-hour sound track or any combination may be produced. The two-pound control unit will ride with the pilot in the single-place cockpit of the XP-38 while the 75-pound machine will be placed elsewhere in the airplane.

Flight engineers cite many advantages of Planetest Magnograph over other test record ng devices. Film records are expensive and require considerable processing before the results of the test are available. Film itself constitutes a fire hazard; Magnograph does not. Film or a wax recording would burn or melt quickly in the event of a fire following a crash. Only intense heat could destroy the tape.

In addition, a five to 10 per cent saving in test flight costs is expected to result from use of the new device. Although Planetest Magnograph costs $3,500, engineers say it would pay for itself in flight test savings on one airplane. It costs nearly $1,000 an hour to test certain types of airplanes. Douglas' DC-4 required 420 hours

Although it costs $3,500, new recording device is expected to save its purchase price in flight test costs. Two more double deck Magnographs are being built for C.A.B. use.

Stenographers can transcribe recordings simultaneously without prior processing.



Eight magnets in foreground record voice on a many separate sound tracks on tape.

of test flying at $996 an hour for its A.T.C.

Only one machine is in existence, but two are being built by the Heller Magnograph Corporation at Los Angeles for the C.A.B. The one Lockheed will use is the first multiple machine of the type. Although the theory is not new, commercial use in the present form is an innovation. The Heller company already has licensed Kollsman Instrument Company to manufacture a smaller $250 dictating machine for general business use which will be equipped with four lines. Through it four persons may dictate at the same time and four stenographers make as many transcriptions simultaneously, just as 16 could on the Lockheed machine.

Heller, known among sound engineers for his recording and reproducing inventions, formerly was chief research engineer for Warner Brothers, motion picture producers, and developed Vitaphone for them.

END

• Model Building Lands Job

CREDIT for his landing a job with the woodworking and fairing department at the new Stinson plant at Nashville, Tenn., is given by James Robinson to his model building activities. Robinson recently won a model competition.

Line Opens School

AMERICAN Airlines has opened an apprentice engineering course for selected students of aeronautical engineering. Object of the year-long course is to develop apprentice airline engineers.

Credit Takes Wings

By Milton Van Slyck

AMERICAN AIRLINES

Vacationists may take air trips or all expense tours and pay costs by installment plan.

OLD timers in the air transport industry who have heard the news are shaking their heads doubtfully—they remember when, in the "good old barnstorming days," flying was strictly a cash on the barrelhead proposition. Now the airlines are going to sell rides on the *installment plan!* Details are all worked out and a uniform credit system is being established.

Just like buying an automobile or a radio, air travelers may sign on the dotted line, take a flight or even an elaborate all-expense tour, then pay for it later at so much per month. Up until a few years ago flying was a cash proposition. Scrip travel cards made the first dent in the time-honored cash-and-fly tradition of the airlines. Scrip is a credit arrangement primarily for large corporate users of air travel whereby no cash is exchanged when transportation is issued, but it does call for an advance cash deposit equal to a portion of the transportation being used. Monthly billings keep the cash deposit on balance at a constant level.

Under the new plan, it'll be *nothing* down, just the passenger's signature! No wonder the old timers are shaking their heads—but it must be remembered that every radically new step is invariably an occasion for head shaking, even in an industry so progressive as aviation. Then, too, perhaps these head shakers aren't familiar with the amazingly low number of delinquencies a sensible credit accommodation produces these days. At any event, and regardless of the "tongue in the cheek" attitude of some industry members, the United States' air transport system will in the near future take a major step toward its long-coveted goal—mass transportation—when it introduces installment ticket selling. Contracts already are in the hands of chief officials of all airlines, including Pan American Airways, and as soon as they are signed and returned the machinery to make possible the installment selling will be set in motion. At this writing it looks like October 1 is a likely date, but it may be a few weeks either way, depending on how (*Continued on page* 64)

Airline credit forms will be like those of railroads.

Aviation's Apostle

by

RICHARD MARTIN

Like others in the 177 cities visited, these 14 first-flighters at Schenectady, N. Y., were given certificates attesting that they handled controls of Williams' Fairchild.

When Roger Q. Williams flew to Rome in 1928, he turned the public's eyes to flying, but his recent national tour put 3,400 groundlings into the air.

TWELVE years ago a young fellow by the name of Roger Q. Williams lifted a heavily-laden plane from the beach at Old Orchard, Maine, and 48 hours later plumped it down at Rome, Italy. Today, a little balder, a little more staid in his ways, and even more of an aviation enthusiast, Col. Roger Williams is selling aviation to the United States—aviation's first apostle.

The term "selling" is perhaps erroneous for the Colonel is not selling aviation—he's giving it away. Giving it away with no strings attached, with nothing but a sincere belief in his product keeping him on the road. He's been selling the sky now for 17 months and he'll open up anywhere—in Horner's Corners or the auditorium at Kansas City. All he asks is an audience that is willing to listen. And he has a message—a message that keeps his audience quiet and attentive as he tells them of this thing we call aviation.

"Whether you are willing to admit it to yourself or not," he says, "aviation is here to stay. If you don't fly during your lifetime, you may accept it as an incontrovertible fact that your children and grandchildren are going to shake off the shackles of the earthbound and bring to themselves a new sense of values which getting up in the clouds engenders."

What started this man off on his Odyssey of wings? It was a writing man, Editor DeWitt Wallace of *Reader's Digest*.

Wallace had a couple of good ideas in mind when he decided to spend several thousand dollars. In the first place, he's a flying enthusiast; in the second place he saw the tremendous future of aviation. With the goal in mind, Wallace had to find a fellow who could reach it. He had to have a man who made an excellent first appearance; he had to have a man whose name meant something to an aviation-ignorant public; he had to have a man who could speak so well what he had to say would stick. He went through candidates like a prairie fire before he found Williams, half concealed behind a mass of blueprints and working models in his New York airplane designing plant.

At first Williams refused to come out of hiding—not because he disliked the idea—but because he hated to stop work on his revolutionary new plane designs long enough to do a little missionary work. But Wallace was not to be denied, and Williams finally put on his coat and pigeonholed the blueprints.

Reader's Digest, with an outstanding national reputation, couldn't afford a risk on this decidedly unorthodox venture. Nobody else had ever tried it and the sponsors had to be sure of their man. Williams was put through a maze of tests that bewildered him. He was shoved out on a stage before hundreds of people and told to start selling aviation. *Reader's Digest* checked his every move to see how he deported himself before crowds. You wouldn't be reading this if he hadn't made the grade. He was given a pat on the back, a Ranger-powered Fairchild and a very expansive expense account.

That was 17 months ago and the Colonel has been traveling ever since. *Reader's Digest* has had to call a halt and no more advance engagements are being accepted. The tour originally was scheduled for 12 months, has run five over that, and the sponsors are satisfied it has accomplished its purpose. Then, too, Uncle Sam has stepped in, opened his money bags and is sending thousands of new private flyers into the air every few months. The apostle of aviation scattered seeds that are bearing fruit. The *Reader's Digest* tour over, he retired to his blueprints and to organize the Williams Aircraft Corporation at Toledo, Ohio. A training school for pilots and mechanics has been opened and manufacture of parts and accessories will start soon. Later Williams plans to build airplanes of his own design. But the blueprints and the school will lose him soon again to the lecturing platform. He plans to continue his speaking tour, to continue to preach aviation to the public on his own.

His Reader's Digest tour ended, Williams has opened a flying school in Toledo.

A few scattered statistics illustrate how thorough a job has been done in bringing aviation to the nation. In a year and a half Williams talked directly to 150,000 persons. It took 457 meetings in 177 cities to get this many folks together under the sponsorship of the local chamber of commerce, junior chamber or civic club. Twenty-nine states have been visited as well as the District of Columbia and Canada. Twenty-seven radio talks have been delivered, bringing the Colonel's message to an estimated 2,000,000 additional people. The Fairchild has logged some 380 hours in covering 48,000 cross-country miles. Not

(*Continued on page 72*)

Flight Instruction FROM THE GROUND

Instructor on stand warns student by radio of mistakes during solo take-off in Aeronca.

by John R. Hoyt

Student solos, with control and supervision of an instructor through a high frequency radio transmitter, help make better pilots.

IF you are training students and your problem child is overhead having trouble with his two-turn spins, imagine what a relief it would be if you could shout: "Elmer, you're skidding! You're diving too much on the recovery. Better do another one to the right." And what a satisfaction it would be to see him turn, climb and repeat the maneuver correctly.

It may sound fantastic at first, but at many progressive centers this instance is a daily occurrence, the only difference being that the instructor does his talking into a microphone and broadcasts on a high frequency allocated to him for just such a purpose. Easy? Of course—in fact, there are so many advantages to the system that a single day's operation may offset the initial cost.

For example, Operator A in a certain state had his transmitter in operation less than a month when he was repaid many times over. His five planes, four of them radio-equipped, were practicing landings, pylon eights, 720's and stalls at various parts of the sky. The remaining plane was out of sight. Without much warning a wind shift occurred, changing the direction of landing 180° from the direction of take-off a few moments ago. A thunderhead began to develop in the distance and the dark, anvil-shaped cloud told of rain, hail and wind to come. The lightplanes would be hard enough to handle by experienced pilots, let alone the solo students who could barely taxi in a zephyr. Immediate action was taken by the operator.

"All planes from the base," he spoke clearly into the microphone, "return to field immediately. Land toward hangar on east runway." That took care of four planes. But the fifth was out of sight. The ship not equipped with radio would be the farthest from the field, naturally. The student probably would lack the presence of mind and the experience either to come home or to flee from the approaching storm. There was a bare chance that he could be brought back in time. The operator decided to try. Once again he pressed the button on the mike.

"Number Four from base," he called. "Remain at 2,000 feet until first three planes have landed. If you can see Number Five, wiggle your wings." One by one the students came in, circled the field and took in the situation. The first student attempted to land the same way he took-off which now had become downwind. The wind was picking up rapidly and a downwind landing might have resulted in a ground loop or an overshot. The instructor admonished him over the radio: "Number One, observe wind sock!"

By the time all three had landed, Four was over the field at 2,000 feet in his position of observer. All hands watched him anxiously as he circled above them and finally they were rewarded by a brisk movement of the plane above them as the pilot wiggled his ailerons and wings. Five had been sighted.

"Number Four from base: Get Number Five at once. Urgent you expedite!"

Without hesitation, Four wheeled upwind and struggled toward the horizon. In true lightplane fashion he seemed to hover motionless in the stiff breeze, but

gradually gained and disappeared from view. Now the question was could both planes return and land before the storm struck—and if so, could both be hangared in the gale certain to be blowing at that time? Making the return trip at better speed than the trip out might help matters somewhat. Four could also lead Five back and make the first landing which would help in preventing the green pilot in Five from accidentally attempting to land downwind. But as the grounded pilots waited the wind shifted a bit. It was essential that Pilot Four land without circling the field as every minute counted. At last the wind veered around 45° from the previous heading and at that moment two planes appeared in the sky moving downwind at a remarkable speed over the ground. The storm was imminent.

"Number Four from base, land northeast on diagonal. Do not circle field. Taxi directly to hangar."

Four wiggled his wings. Behind him Five also wiggled his. He seemed to think it was a "follow me" signal and came in right behind Number Four. The men on the ground swarmed out to meet the two planes as they rolled their short distance to a stop, anchoring the wings and aiding the pilots as they taxied crosswind to the hangar. As the hangar doors clanged shut the hail that fell was large enough to have ruined every fabric covered wing on the field! The saving was conservatively estimated at a figure larger than the price paid for the radio equipment and the operator ordered a receiver constructed immediately for Plane Five.

Building the receiver, assembling and installing the equipment and keeping it going involve costs that are remarkably low. In the conventional lightplane (Class 1-Land) a radio is usually installed where it does not affect the center of gravity; that is, in the baggage compartment or underneath the pilot. The weight is negligible—six pounds including battery—which would change the license only to the extent of one gallon of gasoline.

When the student or advanced pilot uses his radio he first obtains a pair of headphones from the operator and inserts the plugs into the instrument panel. This automatically turns on the filaments so that the radio is on only when the phones are inserted. Because the set is pre-tuned to station frequency, no tuning is necessary—all the pilot does is insert his earphone plug and listen. There is a volume control in the circuit, but it is so designed that it is impossible to cut out the reception entirely. It merely reduces the volume slightly to accommodate those pilots having more sensitive ears than the ordinary. Underneath the pilot, mounted on sponge rubber to prevent vibration, is the tiny radio. The only wiring necessary is the wiring to the jack on the instrument panel and that is very simple. The antenna consists of a short 48-inch rod suspended horizontally about six inches below the fuselage and just far enough aft to remove it from the field of ignition disturbances. The antenna is very short (48 inches) because the wave length is so short (ultra high frequency).

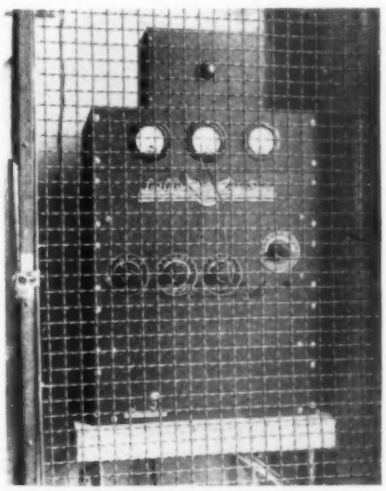
The receivers are simple in construction, consisting of four tubes operated from dry cells. They retail for approximately $40 and incorporate a superheterodyne circuit. With four tubes ample volume is obtained and signals are heard four miles away without a perceptible drop in volume and as fast as eight miles away under favorable conditions. Greater volume would be obtained with five tubes, but this would involve more expense in purchase and operation. The beauty of the system lies in its simplicity and practicability. The instructor who wishes to coach his students in spins, spot landings, steep turned or other maneuvers may do so from the ground. He merely picks up the microphone and presses the button which puts the radio transmitter on the air. The transmitter filaments are lighted at all times and thus available at any moment for emergency use.

The transmitter is rather small—50 watts output. Briefly it consists of a radio-phone set that quadruples the piezo-electric crystal controlling the frequency from about 35 meters to nine meters (more precisely: 8.355 kc. to 33,420 kc.) On this rather high frequency there is no other station to bother or be bothered with since the channel is reserved for airplane instruction and the emission usually travels only as far as the horizon. This means that a large number of such sets may be operated in a large area without causing many interference problems.

What are the obstacles to acquiring such equipment? Aside from the price, they are not unsurmountable. The Federal Communications Commissions, Washington, D.C., will supply information about granting frequencies and permission to operate thereon. Only certain types of approved flying schools may use them at present, but the idea presents such marvelous capabilities that it is bound to spread. Of course, to operate the transmitter one must possess a valid third class operator's permit, but this may be procured upon examination on rules and regulations and does not entail any knowledge of radio code or radio theory. The other item is to have the plane installation approved by a C.A.B. inspector

(*Continued on page* 68)

Student plugs in earphones before take-off, automatically turning on his receiver. He has no transmitter, cannot switch set off. Use of radio has reduced student accidents.



High frequency transmitter is small, can be heard four miles from operation site.

The WATER'S FINE!

by LAWRENCE WARD

Mooring facilities for light seaplanes like this Luscombe have been built every 150 miles along Atlantic Coast.

GROEN HOFF

Private seaplane flying has been given new impetus through bases built by the National Youth Administration and C.A.B.

FOR years aviation enthusiasts have been talking about the tremendous potentialities of the light seaplane but no one seems to have bothered to do very much toward making these dreams come true.

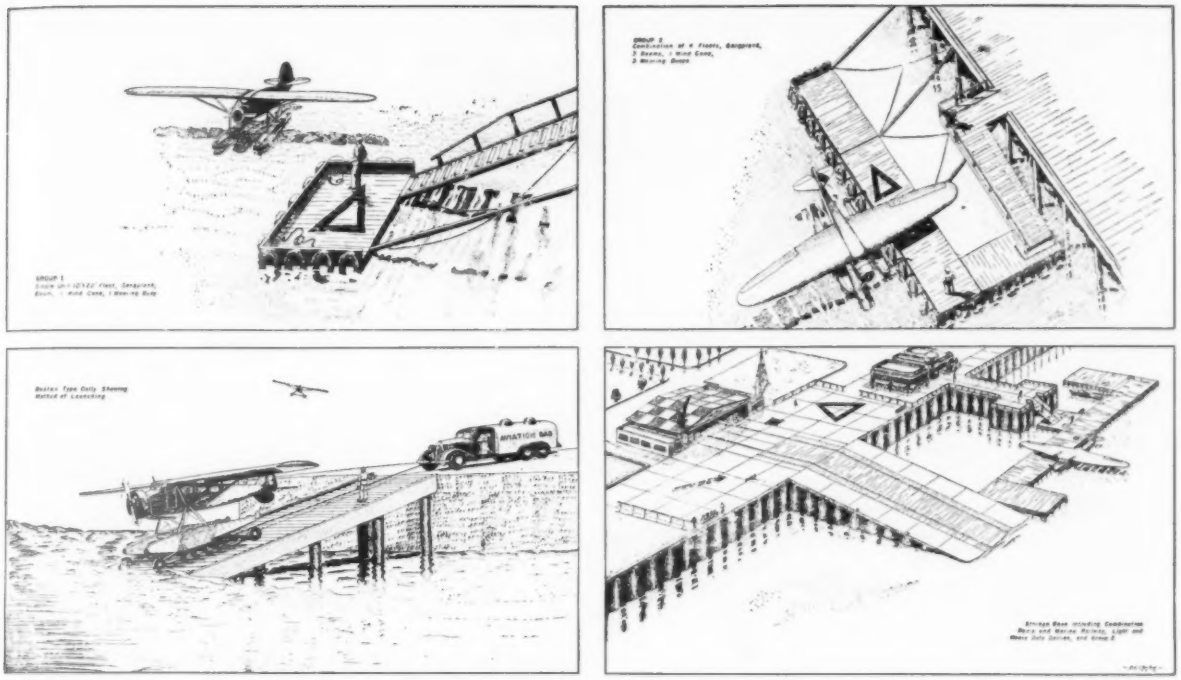
The chief obstacles that had to be overcome were the extremely high cost and heavy weight of pontoon equipment and the lack of adequate mooring facilities for seaplanes in thousands of locations where lakes, rivers or broad streams offered perfect landing spots. The recent perfection of a lightweight rubber pontoon which could be produced and sold cheaply and attached to a plane without noticeably increasing its weight already has begun to obviate the first difficulty. The second is being tackled by a combination of government agencies, chief among them the National Youth Administration and the Civil Aeronautics Board, with tangible results already apparent in well over 500 communities.

This program is interesting for it holds vast possibilities for the future development of an airway system which the private flyer—the "little man" of aviation—can utilize in escaping the stringent regulation, high landing taxes and storage costs which gradually are closing the average land airport to him.

Despite the very obvious lack of facilities private seaplane flying has been steadily developing during recent years. From 40 to 75 seaplanes and amphibians are being built each year, about half for private use. And several hundred private land planes are converted each year for use on water by the addition of pontoon equipment. In the New York area alone approximately 25 seaplane owners commuted to business daily from their homes on Long Island, in Connecticut or New Jersey during the past spring and summer. It has already been determined that both transcontinental and coastwise seaplane routes can be developed if adequate landing facilities can be provided. Moreover it has been found that such facilities cost very little to build and to maintain and for this reason it is possible to construct them in many small communities which for economic or other reasons might not be able to build or maintain airports.

The N.Y.A.-C.A.B. program, launched only last year, is proceeding now in more than 30 states with more than 100 projects already completed along the eastern seaboard. Maine soon will have 26 of the new landing docks. Virginia is installing 17, South Carolina 13, North Carolina 5 and the District of Columbia 1. Three projects in New York City have been completed involving a total of 24 floats. One of these is located at the Wall Street Skyport, one at 23rd Street and the East River and a third at Floyd Bennett Field.

Four major results are anticipated at a result of this plan to provide the nation



Plans for seaplane bases from small floats to big ports, are furnished by the C.A.B.

SEAPLANE FACILITY PLANS
CIVIL AERONAUTICS AUTHORITY
AIRPORT SECTION

with a system of inexpensive and safe landing ports for seaplanes. It will provide hundreds of small towns and cities, which otherwise would be unable to bear the expense of elaborate airports or landing fields, with adequate facilities of this nature. It should stimulate and encourage the use of seaplanes particularly for private travel and thus contribute to the general development of aviation. It will provide a nation-wide network of landing ports with adjacent facilities for fueling and servicing planes, of great importance in the national defense program. It will afford worthwhile work experience to thousands of young people employed by the N.Y.A.—you g men and women who inevitably will be the backbone of tomorrow's aviation industry.

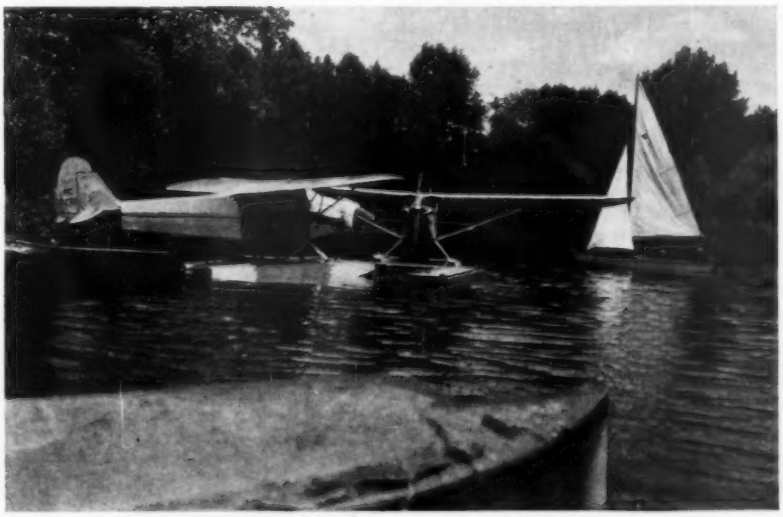
The number of potential convenient and safe seaplane landing ports throughout the United States in little short of amazing. There are few places in the country in which a seaplane need ever be more than 50 miles from a safe landing place because of the widespread distribution of our rivers and lakes. So swiftly has the government's program already progressed that is expected that by fall there will be bases every 150 miles along the Atlantic seaboard from Maine to Florida, along the entire shoreline of the Gulf of Mexico, up through the Mississippi Valley and into the Great Lakes region. Last summer the first link in this latter chain was dedicated by a flying aero cade which touched at a series of 19 seaplane bases extending from New York City to Lake Erie. On the first day it made water stops at Lake Montauk, Oyster Bay, Glen Cove, Newburgh, Poughkeepsie, Kingston, North Germantown and Albany. On the second day it flew through the Adirondack Mountains with stops at Lake George and Westport and on the third day paused briefly at Plattsburg, Ogdensburg, Alexandria Bay, Cape Vincent, Eagle Bay, Speculator, Utica and Fort Plain. Dozens of seaplane owners participated in the cruise, arranged and conducted by the Seaplane Flying Association in co-operation with the New York State Aviation Association.

Spark plug of the program to date has been Captain Robert S. Fogg of the C.A.B. seaplane section. It is he who advised local officials all over the country on the selection of sites and construction of floats and other equipment. Nearly all of the bases have been built at points where there are nearby facilities for refueling, overnight berthing accommodations and service and machine shops.

The project is a co-operative one not only between the N.Y.A. and the C.A.B. but also with the communities involved. The C.A.B. provides the drawings, plans and technical advice. The N.Y.A. supplies the manpower from its roster of out-of-school youth; the community supplies the necessary site and materials. State aviation authorities are assisting the program by surveying the possibilities offered by rivers and lakes within their jurisdiction and submitting recommendations on suitable locali-

(*Continued on page 89*)

The nation's plentiful lakes and streams form natural bases for float-equipped lightplanes.



Arch McGregor, Doug Bothwell, Stan Smith and Capt. J. L. McClelland, Jr., won the Pacific Coast Intercollegiate Air Meet for University of Southern California chapter.

Dr. E. W. Hill, a founder of Alpha Eta Rho, is perpetual president of the fraternity.

GREEKS WITH WINGS

by FRANK CUNNINGHAM

A fraternity without paddles, Alpha Eta Rho builds collegiate aviation interest through flying teams at its chapters.

WITH aviation offering a broader appeal to the public, it is not likely that the field would be passed up by the college students. Though university students have long been active in gliding, the recent C.A.B. government training program has expanded collegiate air activity to an undreamed of degree. But organized college flying interest isn't as recent as all this, for in 1929 Alpha Eta Rho, international aviation fraternity, was founded. This group has made a record that establishes it among the practical-minded leaders of the Greek letter college sphere.

Too often the college fraternity has been associated with pranksters who put the dean's cow on the church steeple and who go through insane initiation stunts and break or have broken on them many paddles. For Alpha Eta Rho all such conceptions of a fraternity must be discarded just as they must be dropped when discussing the professional groups as contrasted with the social groups.

"Because aviation fraternity activity in the college world is represented by Alpha Eta Rho, certainly the group has a place in developing future members of the commercial aeronautical field," said Dr. E. W. Hill, perpetual president of the fraternity. He has seen the group grow from its beginning in 1929 with a chapter at the University of Southern California to chapters at the University of California at Los Angeles, Northwestern, San Diego State, Pasadena Junior College, San Jose State

Movie actor Tyrone Power has donated meet trophy.

Membership in Alpha Eta Rho is open to both men and women students who are interested in aviation. Mexicans, Chinese, Japanese, South and Central Americans are members. Many write Dr. Hill for a solution of aviation problems encountered after their graduation.

and Duke. Plans are being made to install the fraternity at North Carolina State. Chapters are organized on the various campuses when students interested in aviation form local groups, then petition Alpha Eta Rho for membership.

The U.S.C. professor is chairman of the commercial aviation department of the university and handles the C.A.B. training as well. He has long been prominent in aviation education and is one of the founders of Alpha Eta Rho.

"With the tremendous surge being given college aviation, Alpha Eta Rho may well become the fastest growing fraternity in the country," Dr. Hill commented. "I expect that in several years we will be on many times our present campuses. The purposes of the fraternity are to further the cause of aviation in all its branches, to instill in the public mind a confidence in aviation, to promote contacts between students of aviation and those engaged in the profession and to promote a closer affiliation between the students themselves for the purpose of education and research. This fraternity serves as a contact between the industry and educational institutions. It fuses into one organization outstanding students, interested faculty and industrial leaders for co-operation in spreading good will and understanding of the problems of everyday life as influenced by this new modern industry.

"Alpha Eta Rho at Southern California has at present 75 members and there are prospects for some 20 pledges. This membership, of course, doesn't include our numerous alumni who are always welcome to attend chapter functions. Our pledging is carried on through luncheons to which students interested in aviation are invited. The applications for membership are passed on by the local chapter boards. The cost of the fraternity is kept quite low with a $5.00 initiation fee, a $2.50 pledge fee and yearly dues of only $3.00. Activity records of the members show that they are truly interested in aviation and not just students seeking to entrench themselves as potential 'big men' on the campus with fraternity affiliations."

U.S.C. members include LaVerne Ford, chapter president, who is paying his way through college by working in the sheet metal department of Douglas Aircraft; Bette Northrop, vice-president, daughter of John Northrop, famous plane designer and builder; Vernon Elliot, who recently soloed under the C.A.B. and who is working on the night staff of a Pasadena newspaper, and Willard Edwards, technician at radio station KFI.

"Most of us are determined to break into commercial aviation," said Al Gerisch, chapter treasurer. "For my part, I want to work in the management division of some branch of the industry." Dorothy Hill, one of the 25 co-eds in the group and a daughter of Professor Hill, has a private license and hopes to open a flying school. She believes aviation offers many chances for women.

A bit unusual in college circles to find a group so unified in thought as to the future? Probably yes. But Alpha Eta Rho's policy is to keep the student's interest in aviation alive. Dr. Hill knows that from the nation-wide membership of the fraternity will come many of the men—and women—who will contribute to tomorrow's aviation advances. To keep this interest, Alpha Eta Rho offers a wide field of activity. Besides the weekly luncheons, trips are made to plane factories and to allied industries, associate members are taken in to spread good will in the industry. Some chapters publish their own newspapers, cross-country flights are made frequently and many social functions are scheduled. Publicity is given the group's work through motion pictures and radio broadcasts.

A meeting doesn't pass that some well known aviation personality isn't a guest speaker. The Los Angeles area chapters have a much larger field from which to drawn than, for example, the Duke chapter. One luncheon was addressed by Dr. William Wheatley, director of school and college relations for United Air Lines. Dr. Wheatley, who for years was on the staff of Edinboro Teachers College in Pennsylvania, has a family interest in flying as his son, Bill, is chief test pilot of the Consolidated Aircraft Corporation. Usually the speakers bring sets of pictures of new developments or planes and these photos are passed among the students.

Very important to the fusion of the group spirit and to the fraternity's publicity value is the "flying team" that various chapters have. These teams engage in intercollegiate competition. The flying sportsmen bring the "old college try" up to the clouds. Captain of the Trojan team is energetic Scotch-Irish Joe McCelland, Jr., whose vital enthusiasm for aviation seems boundless.

"Certainly I love flying even as all of us do," he said. "We think that college flying teams will promote much in the way of public and campus interest in aviation. You will recall that some 90,000 people saw U.S.C.'s gridders battle Duke's Blue Devils in the Rose Bowl game of 1939. We think the day will come when the U.S.C. Alpha Eta Rho team will try to outwit our North Carolina fraternity brothers before a large, enthusiastic crowd of spectators. Our

R. L. SCHIEVE

Bette Northrop, daughter of plane maker Jack Northrop, is Alpha Eta Rho member.

schedule for the 1940 semester showed meets with, among others, San Diego State, Columbia Broadcasting System, American Air Reserves and the Pacific Coast Intercollegiate Air Meet. In the Coast title meet, sponsored by Alpha Eta Rho, we had entries from Stanford and California where there are no chapters. The winner of the contest represents the Pacific Coast at the national meet held under the sponsorship of the National Intercollegiate Flying Club, at Lock Haven, Pa.

"U.S.C. won the meet held April 27, at Palo Alto. We scored 27 points, edging out Stanford which had 24. In third place was California with 13. U.S.C. also won in 1939, but we didn't go to the national as the trip was too expensive. But this year we're going to reach Lock Haven even if we have to hitch-hike!" The sight of a college flying team thumbing rides on the highway is a bit unusual, but they didn't have to hitch-hike.

One can tell at once when talking with the students that the flying spirit at U.S.C. is high. The team is a cross-section of other squads. Captain McCelland, 23, who insists he was born with a propeller in his mouth, began work in aviation by building model planes. He learned to fly at California Flyers on $22 a month and split up his lessons so that he had eight half-hours a month. His total is 72 hours. Doug Bothwell, 24, is studying commercial engineering and hopes to apply his knowledge in aviation. He got his instruction at Los Angeles Municipal and at Ryan and has been flying three years for a total of 136 hours. Arch McGregor, 20, has over 500 hours. His ambition is to become an airline pilot. He has owned two ships, a Fairchild and a Waco. Twenty-four year old Stanley Smith flies his own Stinson, the *Lady Margaret*, named after his wife, an ardent supporter of the team. He is majoring in commercial aviation. Taught by Randall Scott, he has 250 hours.

These college flyers, as with most of the other members, are not wealthy boys. Many of them have to skimp on the so-called luxuries to get the necessity of time in the air. They feel they are pioneering general college flying and in doing this are helping to advance aviation.

"Our precision flying with our excellent safety record is winning attention for our teams, McCelland said. "Some of our meets have been held with adverse weather conditions, but we haven't had any mar on our record. The purpose of intercollegiate flying is to encourage college competition and to promote public interest in safety in the air." It is doubtful if a large percentage of aviation followers have seen such a meet. Dr. Hill listed the events covered in the usual meet. They are:

Supply dropping: The purpose of this event is to give the boys practice in dropping supplies such as food, medicine and clothing in time of an emergency; aiding the Forestry Service in dropping equipment, spotting fires and searching for missing persons.

Paper cutting: This is done by climbing to 3000 feet and releasing a roll of ticker tape after which the object is to make two distinct cuts by flying through the tape in the least amount of time.

Balloon bursting: The flyer in this event climbs to 2,500 feet and releasing a toy balloon. The pilot endeavors to break the balloon in the least amount of time with his propeller.

Bull's eye spot landing: This tests the accuracy of the flyer's judgment. The object is to land and to measure the distance from the point where the tailskid touched to the center of the circle. The circle is 50 feet in radius.

Spot landing: The spot landing is done by landing beyond but as close to a line as possible.

Perhaps the Alpha Eta Rho flyers are not too optimistic when they forecast a day when newspaper sports "streamers" will herald their sky contests.

When Dr. Hill helped found Alpha Eta Rho, college aviation activity was confined in the main to a few wealthy boys who had planes. His attention drawn to aviation around 1927 when Western Air Express started to fly the mail, Dr. Hill wrote one of the first aviation textbooks, *Air Transportation*, but could get no national publishing house to buy it. "Not enough interest or future to air transportation to warrant college buying" was the usual report. As a final resort, Dr. Hill had the book published by a Los Angeles house. It sold over 4,000 copies!

At U.S.C. 18 years, following adult education work in the Los Angeles school system, Dr. Hill has worked on transportation problems for highways, railroads and waterways. He saw the trend to air commerce even as he saw the need for banding together college students who were air-minded. Then, as now, skeptics are often wont to heckle a professor as a textbook adventurer with no practical experience. Not so with Dr. Hill. From 1927 to 1933, he was education director for Western Air Express and often rode on top of the mail sacks in the converted Douglas observation ships. "I was the guinea pig," he laughingly explains.

The college aviation fraternity was founded by Dr. Hill, an exchange professor from Germany, Dr. R. A. Hershberg, and members of the student body. Several of the original members went into aviation and are now teaching air subjects at various colleges. From its conception the fraternity had no boundaries of race, religion, nationality or sex.

"That is why we are called international," Dr. Hill remarked. "Though the future should bring us chapters in Canada and other neighboring countries, our membership has already been made up of students from the world over. At Southern California this has been especially true with Mexicans, Chinese, Japanese, and boys and girls from Central and South America. When these students leave the campus they keep in close contact with us, even as say the Northwestern members keep in touch with their chapter. One of our alumni members is now a secretary-pilot for a famous Chinese general. Yet whenever a problem comes up that stumps him, he writes back to me for an answer. I teach such courses as air law, problems and principles of commercial aviation, airport management. You can see I'm open to lots of queries from brothers.

"I believe that our group has as equally good a professional record in after school vocations as any fraternity. Our members have made an excellent record in aviation. Because of this we get splendid co-operation from the industry as a whole. I urge most of my students to take four-year courses. One reason is that I want to turn out well-rounded students. If a student specializes in aviation only, he may find out that he doesn't like the field after he gets into it. Without an all-round educational background he may be stuck and, because of his dislike for his work, not advance as he might do in another field. You will note Alpha Eta Rhos are students who cover a broad scope even though aviation is topmost in their minds."

The pilot who flew newsmen from Los Angeles to cover the San Diego state meet at the Linda Vista airport was an alumnus, Laurie Shapiro, who operates his own Stinson commercially out of Van Nuys. The U.S.C. flying activities are carried on at the Gardena Valley field and the cross-country flights are arranged by manager Al Eager.

Members of the fraternity can be recognized by their badge. Patterned after the five-cylinder, radial, air-cooled airplane engine with diagonal propeller, it has three rubies and two emeralds placed alternately in the heads of the cylinders. Local chapters usually award annually an Alpha Eta Rho key for outstanding service by an active member.

Waco Is Busy

ALL departments and personnel of the Waco Aircraft Company, Troy, Ohio, have been placed on a 24-hour basis of three shifts daily to speed production on an order for an unannounced number of YPT-14's for the C.A.B. The planes will be allotted by the C.A.B. to operators having secondary training program contracts.

Early Bird Dick Depew learned to fly in a rickety Farman biplane back in 1911. He has piloted 120 different types since that time.

MODERN VETERAN

by GEORGE R. REISS

Taylorcraft's "mainspring" has been wartime instructor and test pilot, but he'd rather sell planes—and aviation.

IN some quarters Dick Depew is known as the "mainspring" or the "human dynamo." That's because the man fairly radiates energy and driving force. Dick Depew—he's Richard H. Depew, Jr., on his business cards and on the more formal occasions—is a "mainspring" behind the aggressive Taylorcraft Aviation Corporation, of Alliance, Ohio, which builds the Taylorcraft lightplane.

C. Gilbert Taylor, airplane designing engineer, is the father of Taylorcraft, the president of Taylorcraft Aviation, but Dick Depew is the major-domo of the works, the vice president, treasurer and general manager—and together they form a powerful team, a team that is hard to lick. Dick Depew has carved for himself such a prominent niche in aviation—particularly private aviation—that you should know him.

Depew has done virtually everything in aviation, he knows virtually everyone and belongs to virtually everything. He has been a test pilot, flying instructor, Army officer, exhibition flyer, passenger hopper, aerial photography pilot, flying salesman and whatnot. He has been in the aircraft designing, engineering, manufacturing, selling, flying school, charter service and even airport management ends of the game. Depew has flown 120 different types of airplanes—ranging from 1911 model Farmans to modern twin-engined jobs—equipped with 50 different types of engines, three types of autogiros and even a glider or two.

He is one of the earliest of the Early Birds (see FLYING AND POPULAR AVIATION, September, 1940), a Caterpillar, a Quiet Birdman, and even a member of the Society of Automotive Engineers, Institute of Aeronautical Sciences, American Radio Relay League to say nothing of the Alliance Country Club and the Alliance Rotary Club.

But his proudest boast is that he's the man who taught Juan Trippe, president of Pan American Airways, Inc., and Ben Kelsey, Army test pilot, to fly 'way back when. . . .

A powerful fellow in private aviation is Dick Depew, pushing Taylorcraft to the forefront among the lightplane makers, a fellow about whom you're going to hear a lot. A short, stocky, powerfully-built, reddish-haired man, Depew is a forceful fellow, one of those rare executives with an amazing capacity for keeping close tab on a thousand details without getting snowed under with the routine, yet with a faculty for clipping quickly through the maze of red tape to the heart of things.

In his barren, plain little office—adorned with photographs of flying friends and souvenirs of more than a quarter of a century of flying—adjoining C. G. Taylor's office at the Taylorcraft factory—workers dodge in and out quickly with matters for Depew's attention. The advertising manager submits a sample magazine "ad"; a paint shop man has an idea for speeding up the paint work; a designer wants a change in cowling design; the sales manager has a tough nut to crack too—and Depew grasps the idea of each in a single fleeting glance cleaving through the detail like a knife going through a slab of hot butter.

"No," he says to the advertising man, "that 'ad' won't do. It doesn't smack 'em right between the eyes. Try again." He

clips off his words in a precise way, making the meaning clear, and no one questions his word, instantly dodging out of the office.

"Fine," he says turning to the designer. "It ought to add a couple of miles of speed. See what it will cost."

"No," he informs the paint man, "that won't do. It costs too much money."

But when he comes to the sales problem his eyes light up and glisten like the hunter about to turn to the chase. For Depew is the born aviation salesman and his real delight is the end of the chase after the really tough customer when the quarry has been hunted down, talked into submission and has put his "John Henry" on the dotted line.

Depew really is a very early bird with 29 years of experience in aviation. A student at Cornell University, Depew went to Europe with his father in the summer of 1911. Landing in France the youngster heard of the famous Maurice Farman flying school at Buc, France, and resolved to see those remarkable "flying machines" that really flew. So taking a side trip he visited the Farman School, became madly enthusiastic. And the great Farman promised to teach him for a trifling sum of $500.

"Dad, I'm not interested in touring Europe," he informed his father breathlessly. "I want to learn to fly. May I?"

"Sure," replied his father in a matter-of-fact tone of voice as if the lad had asked permission to buy a pack of gum. "Sure, son, you may."

Nothing more. No lectures about the foolishness of it, the danger or the high cost. Remember this was back in 1911 when those "fool aeronautics" were of a breed set apart, a crazy set of freaks with a foolish disregard of life or limb in the eyes of the public, of the same cut as those who rode over Niagara Falls in barrels or walked tight rope across Main Street.

Father Depew generously provided the necessary $500 for flying instruction and young Depew was off. The instruction was just enough to solo the Farman school crates—fine, admirable ships by 1911 standards but awkward, unwieldy, dangerous traps by 1940 standards. No advanced training in stalls and spins, figure eights, 720's, chandelles, simulated forced landings or other maneuvers. No sir. Once you soloed you were a finished aeronaut ready at once to strike out on your own giving exhibtions at $100 or $200 or $500 a throw or training students.

And Depew spent the summer in learning to make eight-point landings in the egg-crate ships—eight point landings because a Farman landed on eight points, four wheels and four skids. Thus Depew, at 19, was given International Aeronautics Federation Aviator's license No. 641 making him the world's second youngest aviator. Depew returned to college studying everything he could find about aviation for the next six years.

Just before the United States entered the World War Depew joined the Curtiss Aeroplane & Motor Corporation's engineering department at Buffalo helping to design and build the famous "Jenny" with

(*Continued on page 70*)

Safe Training Pays Dividends

by Stephen Bates

Dewey Eldred once set a distance record with his Taylorcraft. He devised new bonus system, paying his instructors $50 if they completed their C.P.T.P. classes without accidents.

SAFETY first is paying dividends—in hard, cold cash—to flying instructors in a novel experiment of the Dewey Eldred Flying Service of Cleveland and Willoughby, Ohio. Dewey Eldred, veteran pilot and operator of the flying service, is paying his instructors cash bonuses for eliminating the usual run of student pilot accidents—the broken landing gear, shattered propellers and tattered wing tips—which so long have marked flight training.

And it is working out very successfully. Students at Eldred's Lost Nation Airport never come hurrying up to the hangar, swinging their planes around with a dashing flourish; they never begin to taxi without looking out ahead; they never make successions of bounce landings just for fun and never sneak off surreptitiously to make forbidden landings in a farmer's inviting hay field to take up a friend. That might "shoot" the instructor's bonus.

The experiment began when Eldred contracted to instruct two C.A.B. civilian pilot training program classes of college students, one of them a class of girls from the Lake Erie College for Women of Painesville, Ohio, which was frankly an experiment on the C.A.B.'s part. Eldred, himself a veteran instructor who knew all the tricks of the trade, knew what he could do with the men students, but the class of women was an unknown quantity. He figured it would take only a few torn wing tips, broken props or damaged landing gear to wipe out all the profit on the course—and perhaps even put him "in the hole."

"The answer," Eldred told himself, "is not to have any accidents. Accidents are foolish and unnecessary anyway. And that's up to the instructors." So he cast about for a method of eliminating the minor accidents and hit upon the bonus system.

Eldred made the two instructors, Vernon Finzer and Ben McKillen, responsible for their classes of students, not only when they were up with the students, but also when the students were soloing. When a student flew solo, Eldred required his instructor to be on the field, watching the student's flying with a critical eye. And he offered each instructor a $50 cash bonus if he could complete his class without a single accident.

"There's nothing like having an instructor's own cash involved to make him conscientious about his job," Eldred observed. "He can be the most careful, hard-working, scrupulous lad in the world, but if he hasn't a cent involved, he's bound to be a little more easy-going with his students." The experiment worked perfectly. Not a penny's worth of breakage was done and Finzer and McKillen got their $50 bonuses each. Eldred profited, too, for the $100 paid to the two instructors was much less than he had expected to pay for breakage.

"Besides," said Eldred, "we turned out more careful, safer and more conscientious pilots, some of whom will be renting our equipment from time to time." Finzer and McKillen also are enthusiastic about the bonus idea.

"Of course, a fellow's going to do his level best, bonus or no bonus," said McKillen, "for his reputation's at stake. But

(*Continued on page 74*)

County Nurse Gertrude Lorber gets into a "Cub" to make her professional rounds.

40 Planes Started Something

Fritz Lueneberg, airport manager, greets Joe Berend (right) after his first solo.

by
ROBERT KLECKNER

One morning flight into a run-down airport made a Wisconsin town take notice. Now even the county nurse makes her visits by plane.

FORTY planes swooped down out of the sunrise and were the city fathers awakened! Naturally the county and city bigwigs knew that the airplanes were scheduled to land bright and early that Sunday morning at the municipal airport at West Bend, Wis., but they had no idea of the consequences.

The occasion was one of the many breakfast flights sponsored by the Wisconsin Civil Air Corps and the mayor, other city officials, members of the Kiwanis, Masons and whatnot rubbed the sleep out of their eyes somewhat earlier than was their custom for the Sabbath morn and were on hand at the airport three miles from the city to welcome the visiting flyers from over Wisconsin and a few from Illinois.

It was the first trip to the airport for many of the bigwigs in many a moon and the activity amazed them no little. The pilots were hustled off to breakfast where appropriate speeches of welcome were made in the Masonic temple in the city of West Bend; everybody was happy and a couple of hours later the pilots started to take-off for their home ports little realizing that the memory of those 40 planes would bring tangible results.

Apparently this was the first time that such a number of private airplanes ever concentrated on the municipal airport which had been allowed to run down, fall behind the times. Back in the days that the air mail was flown from Milwaukee to Green Bay, Wis., West Bend had been an intermediate stop and hence the municipal airport. But years ago when the short hops had been discontinued, the airport was relegated to the unenviable position of a city stepchild, rather neglected.

The city officials that Sunday morning saw the landing field jammed with wing tip overlapping wing tip; they heard a couple of visitors jovially ask questions about why don't you do something to improve the airport? No particular criticism was intended by the visitors, but a couple of the questions rather put the natives on the spot. And then when the officials saw that some of their best known citizens—doctors, salesmen, school teachers, nurses—were taking flying lessons at the airport and hoped eventually some day to own their own planes, they decided the best thing to do was get off the spot—and quickly. That is exactly what they are doing. It all goes to show, in a way, just what an organized visit of brother flyers can do. Also it suggests that if the airport won't go to the city hall, take the city hall to the airport.

After that breakfast flight, Mayor Joseph Knippel and City Clerk Kenneth Weiss, along with a few others of the officials, started to ask questions about the city airport and a voluble flood of answers from eager flyers and would be flyers engulfed them. They were surprised to learn the widespread interest in flying at the port, not only among the youth and older citizens of West Bend, but raised eyebrows when they found that some Milwaukeeans drove the 35 miles from the Badger metropolis to take lessons at the now rejuvenated West Bend Airport.

While curiosity may have given the cat a bad name and an untimely end, it still is the genesis of improvement. The city officials got their curiosity aroused and it prompted them to learn they had almost an ideal spot for an airport and that while it was passable for landing and take-off of planes, it still could stand a lot of improvement. That improvement, they discovered further, would not cost a great sum. Upshot is that before spring is over the city is going to level off a few bumps at the airport, improve the runways from 1,900 feet to 3,000 and add 13 acres to the present 60 in the airport. Irony behind the projected improvement is that a few months ago some of those persons now backing the planned improvement were all for plowing up the grassy plot and turning it back to the Indians.

Now the West Bend airport is looking up as are scores of other smaller airports throughout the nation where those interested in keeping landing facilities apace the times have banded together to do something about it. No small factor in the movement to improve this airport was the fact that city officials learned that, under the management of Fritz Luenburg, more students had soloed at the stepchild port in the last year than in all the previous 10 years of the airport's history. Fritz is shy like the pre-transatlantic Lindbergh and actually looks like that pilot did back in the days when brother flyers slapped him on the back and called him "Slim." Fritz has the ability in a

quiet way to instill that supreme confidence necessary for a fledgling flyer to take his plane off the ground and set it down safely again on the solo trip.

The record of the number of students made the city fathers sit up and take notice, and then when they glanced over the roster of pilots, students and enthusiasts at the West Bend airport, their eyebrows went skyhigh. That roster shows in part:

Dr. Adrian Frankow, president of the newly formed West Bend chapter of the Wisconsin Civil Air corps which recently held its first installation of officers and initiation of members; Dr. David Bruns, John Davis, a shovel operator; Garry Graf, shipper; Attorney Lloyd Lobel, George Cassel, bond salesman; John Reis, school teacher; Miss Gertrude Lorber, county nurse; Ernie Gessert and Larse Thompson, mechanics; Louis Ravanelli, Edwin Stremlow, Henry Brynelson, Rod Lueneburg, Henry Batterman and Bill Strong, truckers; Carl Guse, grocer; Joe Berend, tavernkeeper; Jerome Koehler, insurance salesman; Harry Miller, banker; Stanley Werbinski, ditch digger; Ed Melms and Ray Knickelbein, office workers; Bill Compton, salesman; Ben Stanislaw, state *Cub* distributor; Clarence Riepl, manufacturer; Bob Lake, district game warden; and Wilbur Juech, George Brugger and Gayle Hubbard, all policemen.

Game Warden Lake has gone *Cubbing* over a few marshes in search of law violators. Several of the flyers have taken to the air for football games. Others ducked north by plane for the deer hunting season; many fly on business trips.

Running no chances of being overlooked further, the boys have been flying some of the city officials around the state just to keep them air-minded. The school youngsters have been visiting the airport to see if their teacher really can fly. The new chapter of the Air Corps is planning many events to get the whole city aroused.

Among things sponsored at the port was an air show with local talent participating. Trudy Lorber, the attractive nurse and mascot of the airport, inadvertently copped the honors in the bomb dropping contest. She didn't hit the center of the target with her flour bomb. She got a bull's eye—right on an innocent farmer's bull in a nearby field.

END

Transports Bought

UNITED Air Lines has purchased four 14-passenger Lockheed *Lodestar* transports at a cost of $86,700 each. The order, supplementing the fleet of 58 twin-engined Douglas and Boeing transports, increases recent commitments for new airplanes to $9,422,000. The *Lodestar* has a cruising speed of 241 m.p.h. at 62 per cent power output and is capable of a top speed of 264 m.p.h. Fowler wing flaps enable the plane to land at only 68 m.p.h. The transports are powered with 14-cylinder Pratt & Whitney *Wasp* engines. With 14 passengers and 1,000 pounds of cargo, its full load, the *Lodestar* has a single-engined ceiling of over 12,000 feet.

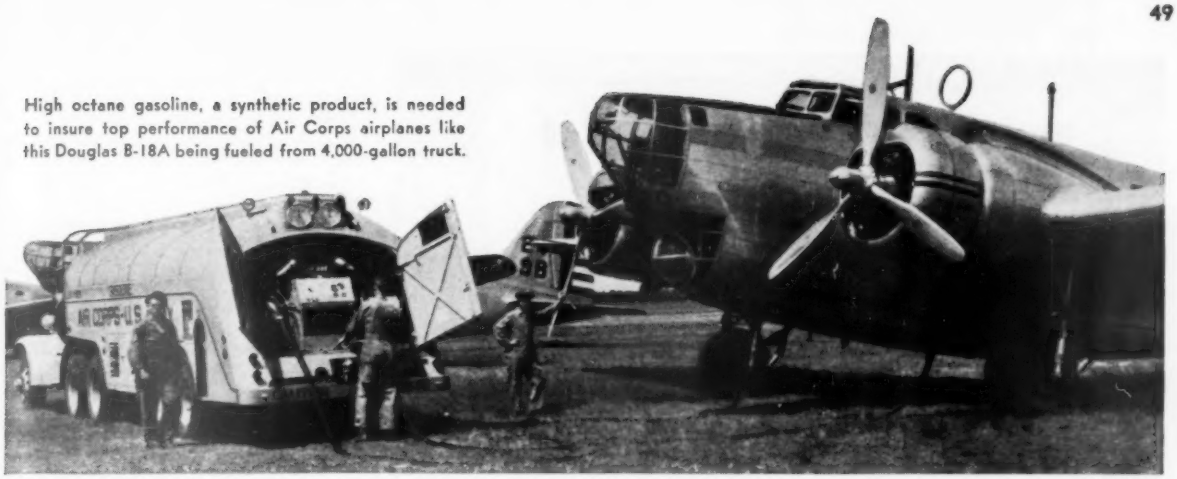
Cows Do Fly . . .

THIS cow didn't jump over the moon but she flew closer than most cows do. Bossie, a native of Palmer, Wash., recently became the property of a McGrath, Alaska, roadhouse owner. Delivery would have taken weeks by boat. Bossie went by air.

Wheels Plus Skis

BECAUSE flying weather and terrain in the far north vary so during spring and fall, one Edmonton, Alberta, Canada, airplane operator has devised this novel method of combining skis with wheels so that quick changes are easily made. Plates of high carbon steel are hinged to the skis and fastened to each side of the wheel by a pin through the stub axle. Small blocks nailed on top of each ski, in back and in front of each wheel, keeps the skis firmly in place. The pilot can quickly attach or remove the skis. Ordinarily, wheels must be removed before skis can be attached.

Detachable skis are shown below on main landing wheels and (right) on tail wheel.



High octane gasoline, a synthetic product, is needed to insure top performance of Air Corps airplanes like this Douglas B-18A being fueled from 4,000-gallon truck.

U.S. ARMY

AERO FUELS TODAY AND TOMORROW

by B. ORCHARD LISLE

Defense speed-up means expansion for the nation's oil industry, production of more high test gasoline.

WHEN it was decided that the United States' air forces should comprise a total of 6,000 first line planes about a year ago, the War and Navy Departments came to the disquieting realization that they had not the slightest idea as to the country's producing capacity for the various grades of aviation gasoline—there just was no reliable data available!

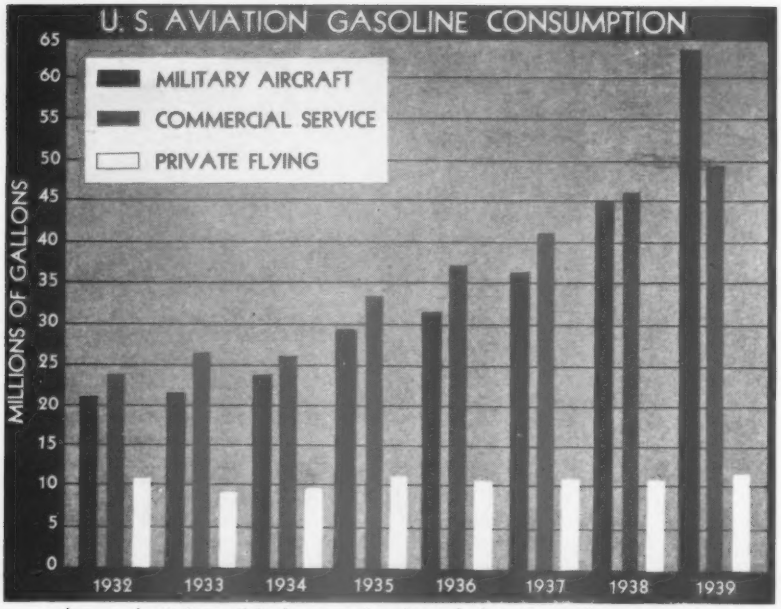
Steps were taken immediately through the Bureau of Mines to make a monthly statistical survey for the information of the armed services, other government departments and leading purchasers of aero fuel. As of October, 1939, these statistics became available and served to reassure military experts of the oil industry's ability to provide the fuel necessary for such an expanded air force. Complaisance engendered by these reports was short-lived—for President Roosevelt demanded that America have a miltary force aggregating 50,000 fighting aircraft at the earliest possible moment! A force of more than eight times as many planes presumably would mean a proportionate increase in fuel demands and the aspect of sufficiency in aviation gasoline supplies could again bear investigation. It was not only the factor of actual quantity which was disturbing, but to a greater extent it was questionable whether the quality of fuel produced in the requisite volumes would be as good as or better than the gasoline currently employed in American fighting planes.

This country has led the world in the development of refining techniques for the production of high-quality petroleum products, one of the most outstanding of which has been high anti-knock value gasolines for use in aero engines. With an excellent reputation for ability efficiently to produce vast quantities of quality products at low cost, the oil industry has no doubt of its ability to meet any demands that may be made upon it, provided that a reasonable time is allowed for the construction of additional refining plants. Gasoline plants already in operation are capable of providing sufficient fuel for about 10,000 fighting ships on short notice. Both the huge integrated oil companies and the major independent concerns are embarked on a vast expansion program for the production of aviation gasoline as well as various synthetics to replace such strategic raw materials as rubber and toluol. These facilities also will be able to take care of the steadily growing commercial consumption. Up to 1939 civilian demand for aviation gasoline was greater than that of the military forces, but last year the Army and Navy expansion programs and the increased training of pilots brought a substantial jump in consumption by the services and commercial use fell back into second place.

Even though the oil industry is confident of its ability to supply the anticipated increase in aviation gasoline demand, Washington is taking no chances and recently has declared an embargo on aviation gasoline for export outside of the Western Hemisphere. This will effect an increase in the nation's reserve stocks and thus reduce the

Stratoliners are using 100 octane fuel for their high altitude, cross-country flights.

TWA



Increased aviation activity has caused nation to look to its petroleum resources.

harm which might be done by possible sabotage.

Undoubtedly the United States is the center of the world's aviation industry just as it leads in the production and treatment of petroleum. There is every indication that the cry will be for gasolines of higher and higher octane number—even though the ultimate possibilities of efficient use have yet to be drawn out of the fuels of regular anti-knock value. At first the new iso-octane gasolines were so expensive that they could only be used by the military, but improvements in refinery plant enabled the oil companies to slash costs to the point where they could be used economically for commercial service under favorable conditions. Pan American Airways was probably the first to prove that by making certain modifications in engine design it would be possible to increase efficiency in long, non-stop flights by burning the more costly fuel.

Higher octane number is an indication that the fuel is suitable for use at higher compression ratios although it also permits an alternative of increased supercharging. When supercharging is employed, change over from 87 octane fuel to 100 octane results in a 20 to 25 per cent gain in power output, but does not vary the fuel economy. On the other hand, increasing the compression ratio when switching to the higher grade of gasoline enables a decrease in fuel consumption by 13 per cent at the same time as the power output is increased by a like amount. Consequently, with the clipper planes flying on the Honolulu schedule powered by engines of higher compression and fueled with 100 octane gasoline, there would be a saving of 320 gallons against the 2 400 gallons required when 87 octane fuel was used. This means that the deadweight of the flying boats would be decreased and the pay load would be increased by 1,960 pounds—a substantial amount when dealing with aircraft efficiencies. Pan American now employs 100 octane gasoline for all its transoceanic services.

The initial use of highest octane fuel for overland air traffic has come but recently. At first iso-octane blends were used for the take-off only, but now that the big *Stratoliners* are in service 100 octane gasoline is employed for the complete run. The trend toward higher ratings for commercial use is getting stronger and soon we may expect some of the lower anti-knock grades of aero gasoline to be dropped from the market.

The most important specifications of a first grade aviation fuel are high anti-knock value, high average volatility, low freezing point, maximum calorific value and a low gum and sulphur content. As aircraft engines operate almost continuously in excess of 60 per cent of their potential power output and at full throttle for the take-off and initial climb—compared with automobile engines which seldom exceed 30 to 40 per cent of their maximum—working conditions are more liable to give continuous detonation than are those in motor car engines. The effect of such knocking is slight in an auto engine, but in an aero engine, where it is less easy to detect, continuous detonat on causes overheating and seizure of the aluminum alloy pistons. Hence, the necessity of a sufficiently high anti-knock gasoline to prevent detonation has assumed such importance as to make it usual to designate the various grades by reference to their octane numbers.

Gasoline of 100 octane (A.S.T.M.) has been available for a comparatively short time and the number of aircraft engines which can derive the fullest advantage from it are limited. The ultimate efficiency of lower grades has yet to be reached by engine researchers, but fuel laboratories already have developed processes for the commercial output of gasolines rated much higher—which will afford considerably greater power output than 100 octane gasoline when engines are designed to take them.

The past decade has taken us from straight-run gasoline of 10 years ago, rarely rated in excess of 75 octane, to the modern synthesized product of 100 to 115 octane. Tomorrow's fuel is provisionally rated at 125. At first a very slight increase in anti-knock value was obtained by addition of benzol. An early step forward in the advance was the introduction of tetraethyl lead, which raised octane ratings of straight-run gasoline to a maximum of 87. It is not a fuel but an organo-metallic chemical used in minute quantities as a concentrated stimulant. Drawbacks have been its corrosive effect, lead deposit on spark plug electrodes and the emission of poisonous fumes. It also loses effectiveness with increasing concentration. Some of these disadvantages have been minimized, if not actually overcome, and it still is the most valuable means of raising the octane number of aero gasolines.

Since 1934 oil refiners have been developing a half-dozen methods for synthesizing high-octane fuels from petroleum, some of them limited by scarcity of raw materials and others capable of widespread adoption because the crude stocks are more readily available. Most of these are very sensitive to lead and instead of being used straight are blended with regular gasoline and then doped. A typical 100 octane fuel may consist of 45 per cent straight-run gasoline, rated at 70 to 76 octane; 45 per cent of alkylate or mixed octanes and 10 per cent of iso-pentane to which mixture is added 3 cubic centimeters of tetraethyl lead per gallon. Another type of gasoline produced by the Houdry process is rated at 77.5 octane, but may be increased to 90 or 92 by addition of 3 cubic centimeters of lead. Blended with 30 per cent commercial iso-octane and the same amount of dope it reaches the 100 octane mark.

There are a number of processes—cold acid, hot acid, catalytic and thermal polymerization, alkylation, catalytic and hydroreforming, super-fractionation and hydrogenation—which are capable of turning out blending stocks with valuable potentialities for raising the anti-knock rating of straight-run gasoline in conjunction with tetraethyl lead. Catalytic hydrogenation produces a gasoline by direct polymerization of octenes which has a value of 98 to 100 octane and has a proportionately high blending value. Thermal polymerization distillate has an octane blending value ranging from 80 to more than 100.

Latest of the new aviation fuels to reach the commercial stage has been Phillips Petroleum Company's neohexane, a alkylation product of ethylene and iso-butane. Rated at 95 to 100 octane, its high volatility makes it unnecessary to add straight-run gasoline as in the case of iso-octane. Blends of neohexane, iso-pentane and iso-octane, with addition of lead, will provide an adequately balanced gasoline rated at 115 octane by conventional testing apparatus.

Perhaps the developments in aviation gasolines during the next few years will result in a major reduction in size of aero engines—such was the pred ction of Dr. Gustav Egloff, who with his research staff in Chicago has developed triptan, a fuel of 125 octane rating and possessing twice the combustive power of 75 octane gasoline. The laboratory cost already has been reduced from $3,600 per gallon to $50 and, if developed as quickly as was iso-octane, should reach the 30-cent stage in about five

(*Continued on page 76*)

BELLANCA

Cruisair, 14-9

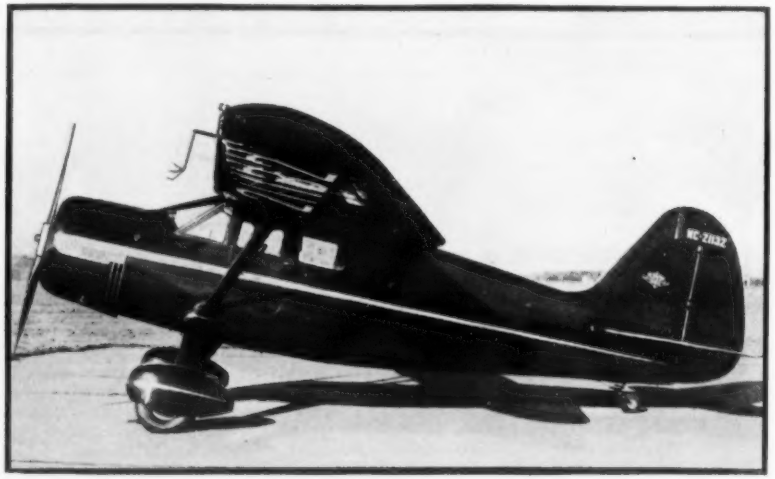
Bellanca Aircraft Corporation — New Castle, Delaware

SPARTAN

Executive, 7W

Spartan Aircraft Company — Tulsa, Oklahoma

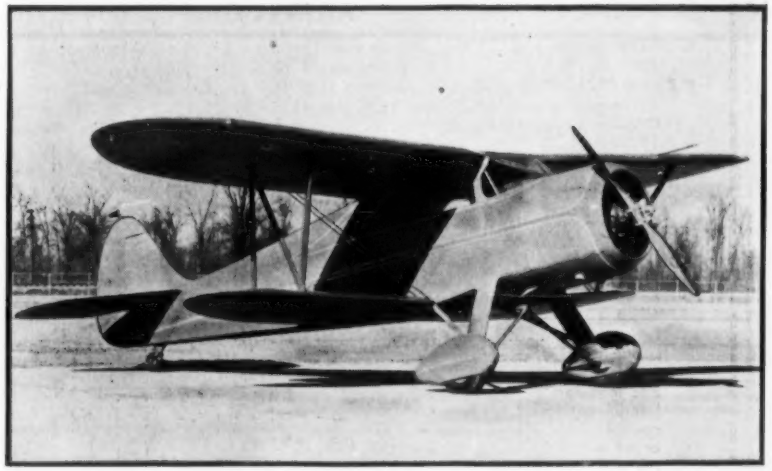
AIRCRAFT



STINSON

Reliant, SR-10C

Stinson Aircraft Corporation — Nashville, Tennessee



WACO

Aristocrat, A. R. E.

Waco Aircraft Company — Troy, Ohio

SPARTAN EXECUTIVE, 7W

COSTS: List price: $23,500. Minimum down payment: not available. Annual insurance premium: $235. Operating cost per hour: $36.35; 19.13 cents per mile (including fuel, oil, plane and engine maintenance, depreciation, storage and insurance).

PERFORMANCE: Miles per gallon of fuel: 8. Cruising speed at 75% h.p.: 200 m.p.h. Maximum speed at 5,000 feet: 212 m.p.h. Stalling speed: 65 m.p.h. Cruising range (excluding 10% fuel reserve): 800 miles. Service ceiling: 24,000 feet.

SPECIFICATIONS: A. T. C. No. 628. Type of airplane: CLM. Type of construction: all metal. Engine: 400 h.p. Pratt & Whitney Wasp Jr. SB. Fuel capacity: 112 gals. Weight empty: 2,987 lbs. Weight loaded: 4,400 lbs. Span: 39 ft. Height: 8 ft. Length: 26 ft. 10 in. Wing area: 250 sq. ft. Wing loading: 17.6.

ACCOMMODATION: Number of seats: 5. Baggage: 100 lbs.

EQUIPMENT: Instruments (standard on this model): Sensitive altimeter, engine gauge unit, ammeter, cylinder temperature gauge, outside air temperature gauge, fuel gauge, carburetor air temperature gauge, vacuum gauge.
Interior fittings: Custom-built upholstery, dome and map lights, ash trays, foot rests, assist cords, window drapes and carpets.
Propeller: Hamilton Standard, metal, constant speed.

SPECIAL FEATURES: Vacuum operated flaps, retractable landing gear, dual controls (fixed or throw-over type optional).

WACO ARISTOCRAT, A. R. E.

COSTS: List price: $13,750. Minimum down payment: $4,566.67. Annual insurance premium: $1,335.75. Operating cost per hour: not available.

PERFORMANCE: Miles per gallon of fuel: 10. Cruising speed at 70% h.p.: 177 m.p.h. Maximum speed at sea level: 185 m.p.h. Stalling speed: 60 m.p.h. Cruising range (excluding 15% fuel reserve): 1,080 miles. Service ceiling: 18,000 feet.

SPECIFICATIONS: A. T. C. No. 714. Type of airplane: CLB. Type of construction: Mahogany plywood wings; welded steel tubing, fabric-covered fuselage. Engine: 330 h.p. Jacobs L6. Fuel capacity: 125 gals. Weight empty: 2,563 lbs. Weight loaded: 4,001 lbs. Span: 34 ft. 9 in. Height: 8 ft. 8 in. Length: 27 ft. 10 in. Wing area: 246 sq. ft. Wing loading: 16.25.

ACCOMMODATION: Number of seats: 5. Baggage: 100 lbs.

EQUIPMENT: Instruments (standard on this model): Altimeter, airspeed indicator, bank and turn indicator, rate of climb indicator, compass, electric fuel gauges, manifold pressure gauge, oil pressure gauge, oil temperature gauge, tachometer, carburetor and outside air temperature gauge with selector switch, single lead thermocouple, volt ammeter. Electric starter, 15 ampere generator, navigation lights, landing lights, instruments indirectly lighted by rheostat control and mounted on shock-proof panel supported by rubber bushings.
Interior fittings: Toe-operated hydraulic brakes, dual rudder pedals, throw-over control wheel, cabin heater and ventilators, front seats adjustable fore and aft, automobile type spring base with curled hair cushions covered with broadcloth, ash trays, assist cords, rear seat arm rests, tool kit, first aid kit, fire extinguisher, tie down ropes, rear seat reading lights, map light for front seats.
Propeller: Hamilton Standard, metal, controllable pitch.

SPECIAL FEATURES: Electrically operated flaps, Waco type enclosed engine cowl with pilot-controlled ventilator.

BELLANCA CRUISAIR, 14-9

COSTS: List price: $3,975. Minimum down payment: $1,457.50. Annual insurance premium: $397.50. Operating cost: $6.32 per hour, not including hangar storage.

PERFORMANCE: Miles per gallon of fuel: 22. Cruising speed at 75% h.p.: 120 m.p.h. Maximum speed at sea level: 135 m.p.h. Stalling speed: 47 m.p.h. Cruising range (excluding 10% fuel reserve): 392 miles. Service ceiling: 12,500 feet.

SPECIFICATIONS: A. T. C. No. 716. Type of airplane: CLM. Type of construction: Fuselage of fabric-covered steel tubing; wings of wood. Engine: 90 h.p. Ken-Royce 5F. Fuel capacity: 20 gals. Weight empty: 1,010 lbs. Weight loaded: 1,700 lbs. Span: 34 ft. 2 in. Height: 6 ft. 3 in. Wing area: 161.5 sq. ft. Wing loading: 10.5.

ACCOMMODATION: Number of seats: 3. Baggage: 60 lbs.

EQUIPMENT: Instruments (standard on this model): Compass, airspeed indicator, tachometer, altimeter, fuel pressure gauge, oil pressure gauge, oil temperature gauge.
Interior fittings: Chrome-plated chair frames, leather upholstery, seats provide for parachutes, wood grain instrument panel.
Propeller: Sensenich fixed pitch, wood.

SPECIAL FEATURES: Retractable landing gear.

STINSON RELIANT, SR-10C

COSTS: List price: $10,995. No standard minimum down payment. Annual insurance premium: $1,484.33. Operating cost: 12 cents per plane mile.

PERFORMANCE: Miles per gallon of fuel: 8.2. Cruising speed at 85% h.p.: 147 m.p.h. Maximum speed at sea level: 149 m.p.h. Stalling speed: 58 m.p.h. Cruising range (excluding 10% fuel reserve): 620 miles. Service ceiling: 15,000 ft.

SPECIFICATIONS: A. T. C. No. 678. Type of airplane: CLM. Type of construction: welded steel tube. Engine: 260 h.p. Lycoming R-680-D5. Fuel capacity: 76 gals. Weight empty: 2,525 lbs. Weight loaded: 3,900 lbs. Span: 41 ft. 10½ in. Height: 8 ft. 7 in. Wing area: 258.5 sq. ft. Wing loading: 15.1

ACCOMMODATION: Number of seats: 5. Baggage: 150 lbs.

EQUIPMENT: Oil pressure gauge, oil temperature gauge, fuel gauge, altimeter, compass, tachometer, carburetor air temperature gauge, manifold pressure gauge.
Propeller: Hamilton Standard, metal, controllable pitch.

SPECIAL FEATURES: Vacuum operated flaps; single strut, semi-cantilever wing; hinged cowl.

SPARTAN EXECUTIVE, 7W COSTS: List price: $23,500. Minimum down payment: not available. Annual
BELLANCA CRUISAIR, 14-9 COSTS: List price: $3,975. Minimum down payment: $1,457.50. Annual insur-

APPLIED AIRCRAFT AERODYNAMICS

by RAOUL J. HOFFMAN

AERODYNAMICS is the study of the motion of the air and its dynamic effects on an object, especially an airplane.

Performance of an airplane depends on the physical characteristics of the air, its density and viscosity. These factors are again affected by the temperature, barometric pressure and humidity of the air. For simplicity in engineering calculations, all performances are evaluated with the adopted standard air at sea level, for a temperature of 50° Fahrenheit and a barometric pressure of 29.92 inches of mercury (1013.2 millibars). The specific weight of standard air is .07651 pounds per cubic foot; the mass density or density is .07651 divided by the gravity or .07651 ÷ 32.174 equals .002378 slugs per cubic foot. The viscosity of the air is 373 divided by one billion. Another function used is the kinematic viscosity, which is the viscosity divided by the density or 1/6380 seconds per cubic foot, called the Reynolds number (Section 5).

For ready reference, data and formulae are appended. Section 1 shows a chart of the average temperature of the air at various altitudes. Section 2 gives the pressure of the air on a square foot surface if vacuum is present on the reverse side of the plate. Another interesting notation shows that dry air is heavier than air saturated with moisture.

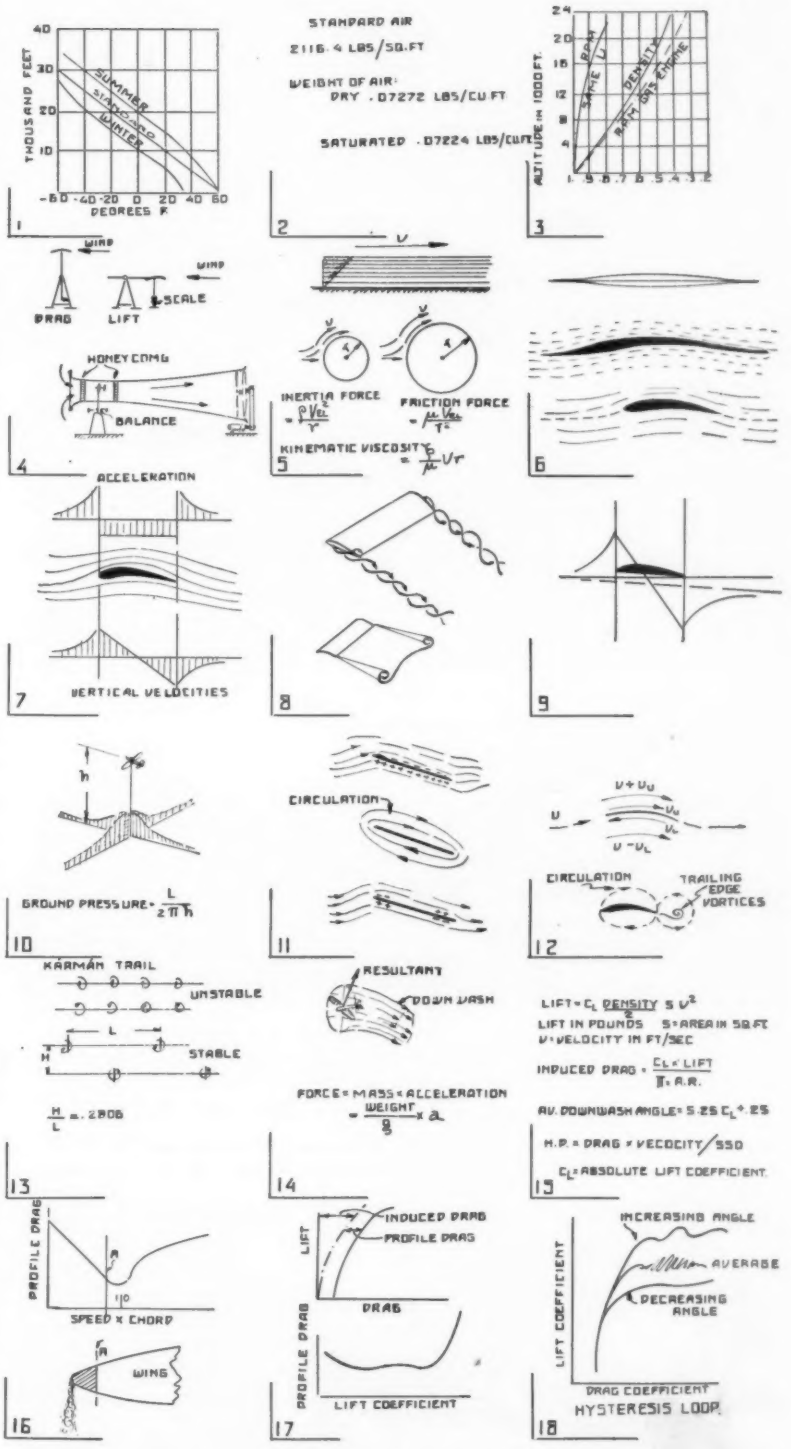
Engine power, if not supercharged, varies with altitude. In Section 3 a diagram shows the change of density, change of power for the same r.p.m. and the change of r.p.m. for the same air speed using internal combustion engines. All curves are plotted from actual flight tests.

Tests on wings (airfoils) can be conducted without resorting to full-sized airplanes. In the early days of aviation wings were mounted on a pivoted lever and the lift and drag forces measured with a spring scale as sketched in Section 4. By placing a flat disc on the instrument, the wind speed may be calculated with fair accuracy. This crude method gave only comparative values on the efficiencies of airfoils. Consequently wind tunnels were built in which not only drag and lift could be measured, but stability and center of pressure and many other problems studied. An outline of a conventional wind tunnel is shown in Section 4. Lately all wind tunnels are inclosed in order to get higher velocities with the same power plant. Some of them increase the air pressure to get the same effect high speed will give.

Wind tunnel tests can never predict the exact performances of a full-sized airplane if models were used in the tests. The proximity of the walls and the disturbed air takes too many corrective factors. Aviation, however, received most of its advancement from wind tunnel tests in conjunction with mathematical evaluations.

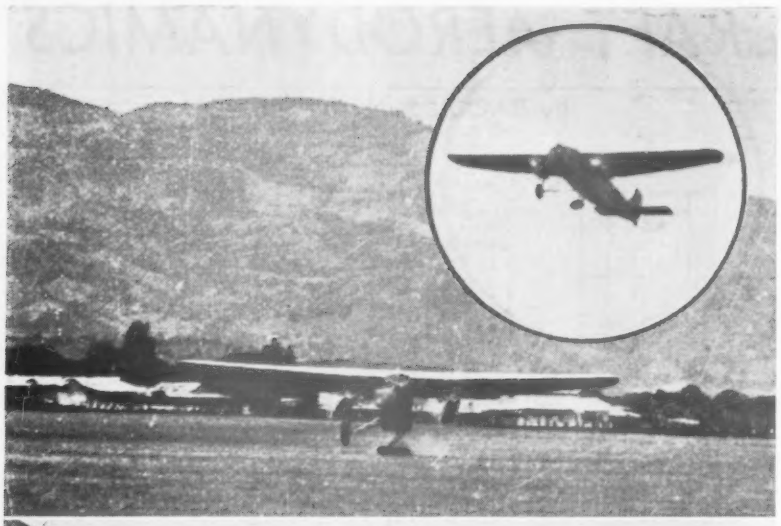
Laboratory tests show us that a flat disc at 100 m.p.h. has a resistance of 32 pounds for each square foot area and it requires 8.55 effective horsepower to propel it for-

(*Continued on page* 78)



Aerodynamic factors in airplane design are plotted by wind tunnel tests and formulae.

HAVE YOU SEEN ?



ROBERT EDGERTON

Left wheel shock strut snapped when this ENTA Airlines Ford took off in Costa Rica. Pilot noticed missing wheel (inset) on flight to 3,900-foot altitude San Jose airport where he came down for one wheel landing (top). Wheel and broken strut plowed furrow in field (center) before ship settled on its left wing. Eight passengers were unhurt.

Sergt. Frank Medina (left) and Lieut. Juan Rios Montenegro will make a good will tour of North and South America in 450 h.p. Wright-powered Howard DGA-15W for Cuban Navy.

RUDY ARNOLD

Four Randolph Field cadets try some table-top horseplay between flights. Chief pilot spots landing field for "Flying Fortress."

Crew chief (left) throttles "engine"; the pilots haul stick to get the tail down; Navigator navigates a model for landing.

U. S. ARMY

Training planes are bad enough to land, so entire crew battles to get "bomber" tail down. Crew made the "landing" on floor.

STANLEY EASTY

Rear seat of Piper "Cub" trainer makes a good spot for nap between training hops for this instructor at Charlotte, N. C.

First Aeronca C-2, built in June, 1929, has returned to Middletown, Ohio, plant under own power for exhibit in museum.

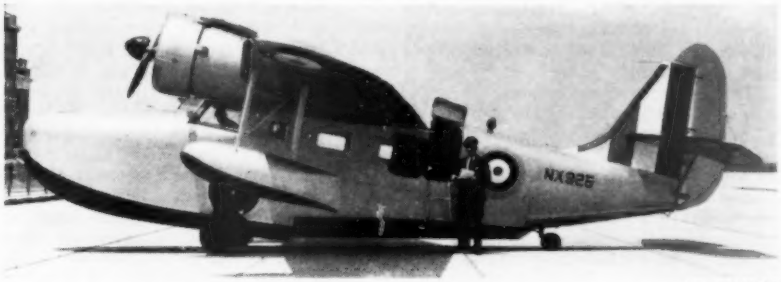
M. B. BAKER

Don Berent and Danny Fowlie attached two "Cubs" for pick-a-back flight, did not break contact until just before landing.

INTERNATIONAL; ACME

Original prototype of Navy's Martin XPBM-1 had flat tail structure (top). Recently tested model has altered tail. All-metal flying boat has retractable wing floats.

Naugle Aircraft Corporation of Latrobe, Pa., is testing new 75 h.p. Lycoming engined plane which has a top speed of approximately 130 m.p.h. and landing speed of 40 m.p.h.

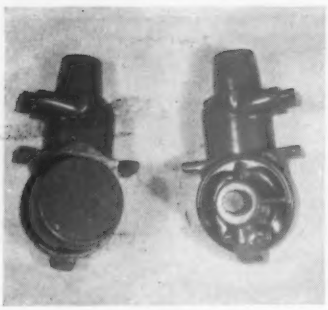


RUDY ARNOLD

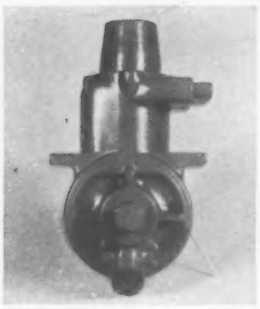
First of a Canadian Defense Department order, this Grumman G-21A amphibian has flown to Canada from New York. It is powered with two 400 h.p. Pratt & Whitney "Wasp Juniors."

Sleeping compartments in the wings, a library, restaurant are features of the Russian L-760. Plane weighs 40 tons, has six engines, carries 64 passengers and crew of eight.

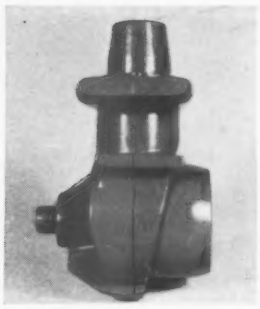
INTERNATIONAL



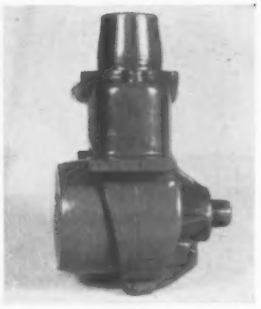
Main pattern for engine should part with ease when put in sand.



Front view of pattern shows air intake, exhaust details.



The large exhaust, on right side, is an integral part.



Air intake angle, permitting supercharging, is noteworthy.

THIS MONTH'S MODEL

by PAUL W. LINDBERG

Model Editor and Designer

Developed after several months of research, here is a Class C model gasoline engine which can be built of low cost materials.

SEVERAL months of experimental and development work has resulted in a fine class C model aircraft engine. All the latest improvements have been incorporated into this unit, such as maximum porting of both intake and exhaust, rotary crankshaft admission valve, transfer integral with cylinder and heavy duty ball bearing thrust with hardened steel races. Cylinder and head are made of one piece in order to eliminate compression leakage. An aluminum cylinder head is used for appearance and better cooling qualities. Raw materials for building this engine, not including coil condenser or spark plug, should cost approximately $2.50.

This engine develops between 1/5 to 1/4 h.p. and is well suited for any class C airplane or can be used on models equipped with radio control. It also can be used to power midget race cars or boats.

Due to increased interest in constructing model gas engines, there have been prepared detailed drawings as well as comprehensive descriptive matter. This article will deal only with the construction of the patterns from which the aluminum castings are made. All drawings are full size, therefore adhere to them closely as possible for they are designed to take care of any aluminum shrinkage. All patterns are made from genuine patternmaker's white pine. Begin with the connecting rod.

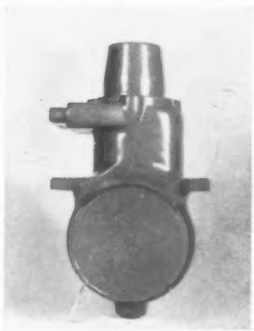
Cut from 3/32 inch sheet stock two plates to outline shape of top view of the connecting rod. Slightly taper all outer edges as shown in side view. This will permit easy withdrawal from sand. Plugs which form the housings are turned on a lathe and later attached to the connecting rod. Recess in arm is carved out by hand. Building the main pattern will require a great deal of time and patience. The job is not as complicated as it appears, but your best efforts should be used here to obtain a perfect job. From a block 2¼ inches square and approximately 4 or 5 inches in length the two halves of crankcase may be turned up. Turn up both the front and rear part of the crankcase with a space of ¼ inch or more between the centers which is later cut completely through to form parting centers of pattern. Please note: In trimming the front half do not forget to turn the core in the pattern at the same time. Make sure that both halves have a slight amount of draft so that they may be pulled easily from the sand. The back face of the rear half is cut off at an angle as shown in the side view. Sand until a very flat and accurate surface is had. The core is turned on the lathe. Attach it to back of the pattern, making sure the correct angle is had before gluing it in position.

Sections are now attached to the top of the crankcase to form motor mount lugs. They consist of two pieces of 3/16 inch thickness. Sand in order to obtain draft as shown in the side view, only a small amount is necessary. Space between crankcase and lug is filled in with plastic wood. From two pieces, ¾ inch by 1½ inch by 5 inches in length the cylinder housing and core are turned. At either end of the block ½ inch in from the ends, two wood screws are used to hold the pieces together while turning. The exhaust and transfer section may now be added with plastic wood for filleting. By studying the plan carefully any small details such as section for air intake, braces, etc., can easily be worked out.

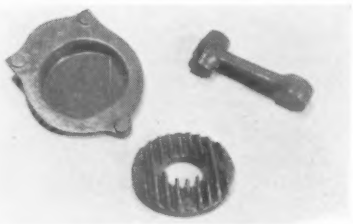
In making the cylinder head, it is very important that the fins have the right amount of draft as shown on the plan so that a clean casting may be had. The fins are attached separately to a flat disk. Fillets at the bottom of the fins may be made by using fillers. No trouble should be had in making the rear crankcase cover plate. Follow the dimensions closely and make sure that both faces are very flat.

A detailed drawing is shown of the core box. The best method to make this is to build it up in a series of blocks. Do not

(*Continued on page* 89)



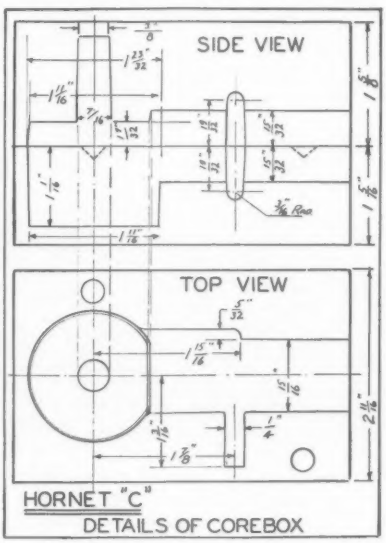
Recess is made between lugs cast at rear of the engine.

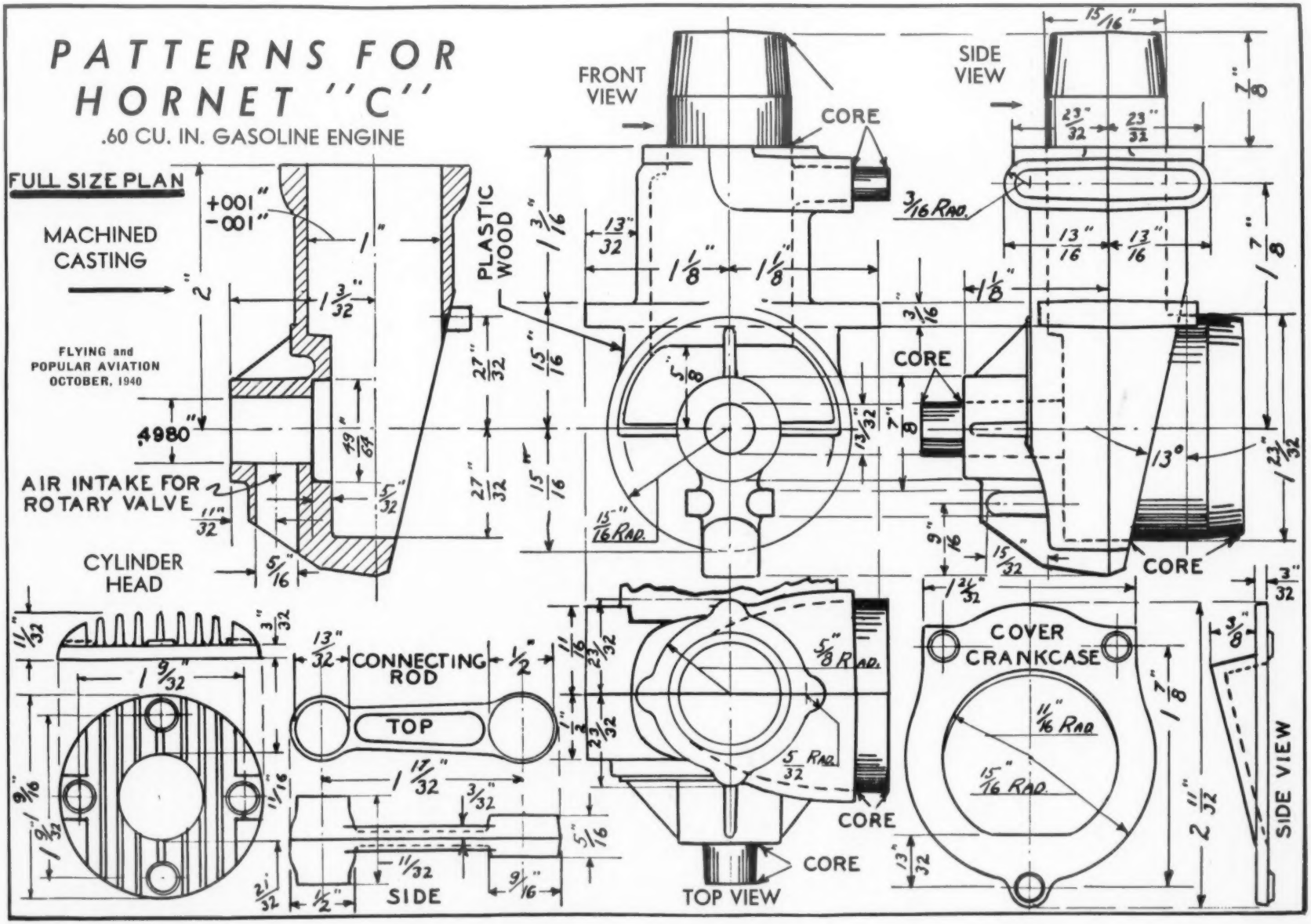


PHOTOGRAPHS BY N. R. STROHMEYER

Cylinder head, crankcase cover, connecting rod patterns are designed for strength.

Corebox may be built from the plan below.




PATTERNS FOR HORNET "C"
.60 CU. IN. GASOLINE ENGINE
FULL SIZE PLAN
MACHINED CASTING
FLYING and POPULAR AVIATION OCTOBER, 1940
AIR INTAKE FOR ROTARY VALVE
CYLINDER HEAD
PLASTIC WOOD
FRONT VIEW
SIDE VIEW
CORE
CONNECTING ROD
TOP
SIDE
TOP VIEW
COVER CRANKCASE
SIDE VIEW

Air Power Will Dominate the Pacific

(*Continued from page* 13)

3½ feet of water. I have landed crated pursuit planes in an open roadstead, set them up and made them ready for flight in a couple of hours.

Aircraft may be carried as deck loads on submarines; a modern submarine may carry six or more. They can be landed in their own waterproof cases and set up in a short time. The cases can be used as boats and lighters for the debarkation of other supplies. In operating overseas, a well organized air force can be ready to strike within six hours of its arrival at its debarkation point.

Any operation in the air requires that the advantages to be derived from it must be fought for, just as a corresponding operation on land requires armed contact, because if it is worth while, the enemy will attempt to stop it. To insure the operation of aircraft, pursuit aviation must be concentrated at the decisive points at the beginning of operations. To be effective, aviation has to act in concentrated compact bodies, otherwise it can be defeated in detail no matter what the size of the opposing force may be. For this and other reasons, an air force cannot operate with success from floating or seacraft airdromes against an airforce firmly established on land airdromes. There is nothing whatever to fear from so-called naval airplane carriers, because not only are they unable to operate efficiently on the high seas but even if this were possible, they could not place sufficient aircraft in the air at one time to insure a concentrated operation. Consequently, a hostile air force will seize land airdromes from which to launch its attacks against its intended victims.

At present due to the efforts of our Navy, practically our whole defense in the Pacific is based on the Hawaiian Islands. Everybody knows it and there is no secret about it. Foreign nations know it better than we do. The American people ought to be informed what a terribly dangerous position we have been put in by basing our defense of the Pacific on a navy instead of on air power.

Our Hawaiian Islands have been termed "The Crossroads of the Pacific," because the route of water-borne traffic going from the Panama Canal to Asia passes directly by them, as do the routes from our Pacific coast to Australia, to the southern part of Asia, the Dutch East Indies and the Philippines. Before the coming of air power, these islands had great strategical value as a base for a campaign from the North American continent against Asia, because they constituted the first stopping point for navies proceeding through the Panama Canal or acting from the Pacific Coast. Since the development of air power to the point where airplanes can sink battleships with the greatest ease, a naval campaign in the old sense against Asia is an impossibility, consequently this value no longer exists. The position of Alaska is much more favorable for a campaign against Asia by air and submarine than is that of the Hawaiian Islands, because the distance is shorter.

The value of Hawaii as an air base for the Japanese, however, is very great, because direct attacks could be carried out from there against our Pacific Coast cities and the interior of the country. The possession of the Hawaiian Islands depends primarily on who controls the air above them. They can be taken by air attack or held by air defense. It will well repay us to hold them on account of the comparatively small outlay in men and money that would be required to equip an air force sufficient for their protection.

Hawaii lies 2,402 miles from our Pacific Coast. There are seven inhabited islands arranged in a curving line from northwest to southeast. The distance from the northern inhabited island, Niihau, to the southern inhabited island, Hawaii, is about 350 miles, or three hours' flight for an ordinary airplane *(About two hours today.—Ed.)*. A fact not ordinarily thought of, except by airmen, is that a line of small islands and reefs extends from the main islands directly toward Japan for a distance of 1,100 miles, to Midway Island. Practically all of these little islands and reefs are capable of being made into air bases, observation points and radio stations. *(Pan American Airways—and, of course, the U. S. Navy—now have excellent air bases on Midway, Wake and Guam Islands.—Ed.)*

"Hans, vy didn't ve tink uf flypaper? . . ."

Midway is about 2,000 miles from Japan or about the same distance that Honolulu is from San Francisco. It is 1,300 miles from the Aleutian Islands of Alaska. With ordinary slow speed aircraft, the Japanese could reach Midway in 20 hours and American planes could reach Honolulu in 20 hours *(Pan American's schedule today is 19 hours.—Ed.)*; or a flight could be made from the Aleutians to Midway in 13 hours. Migratory birds fly from the Hawaiian Islands and nest in Alaska. The small Hawaiian finch, which is unable to land on the water, makes the flight each season over these vast expanses of sea. So does the Hawaiian plover. The flying machine can do this much more easily than can the birds, on account of its power and navigability in storms.

Our present system of defending the Hawaiian Islands is perfectly ridiculous. The last time I looked it over, I thought to myself that it was no more efficient in this day and age against a modern air attack than were the Hawaiian Islanders, running up and down the beach with their spears and yelling at the top of their voices, when Captain Cook came there in 1774. Our defense is based on a land army, coast defense guns and battleships, all of which are uncoordinated. A modern boy 15 years old, who knows about airpower and has had simple military training in high school, could work out a better system. *(Both the Army and Navy now have large concentrations of airpower in Hawaii.—Ed.)*

As the defense of the Hawaiian Islands is based on the assumption that an attack would be made against them by the Japanese, let us assume a state of war to be impending between the United States and Japan and the mission of the United States forces in Hawaii to be the holding of the Island of Oahu for four months before the arrival of supporting troops. Let us estimate what the action of Japan would be. Japan knows that she owes her existence to the latest developments in the art of war. She cannot hope to prevail against a great power like the United States, any more than she would have against Russia, had she—Japan—still used the organization and methods of her traditional military policy and system. She knows that the United States will probably enter the next war with the methods and weapons of the former war and will, therefore, offer the same enticing morsel that other nations have done that have followed this system before. She knows defense of Hawaii is based on an army and navy and not an air force.

The Island of Oahu, with its military depots, airdromes, water supply—and the city of Honolulu with its wharves and supply points—forms an easy, compact and convenient object for an air attack. The whole area of the island is about 650 square miles, of which one-half is very mountainous while the rest is taken up in great part by agricultural developments. The area having an important military bearing consists of about 100 square miles or about the same military area for air defense as the city of New York.

In selecting the weapons to be used against a location of this kind, an air force has the choice of toxic gases, explosive bombs of various sizes and phosphorous and incendiary bombs of different categories. The means of applying these weapons consists of the aerial torpedo which, in substance, is an airplane controlled and directed by gyroscopes and radio, which can be applied anywhere

(*Continued on page* 62)

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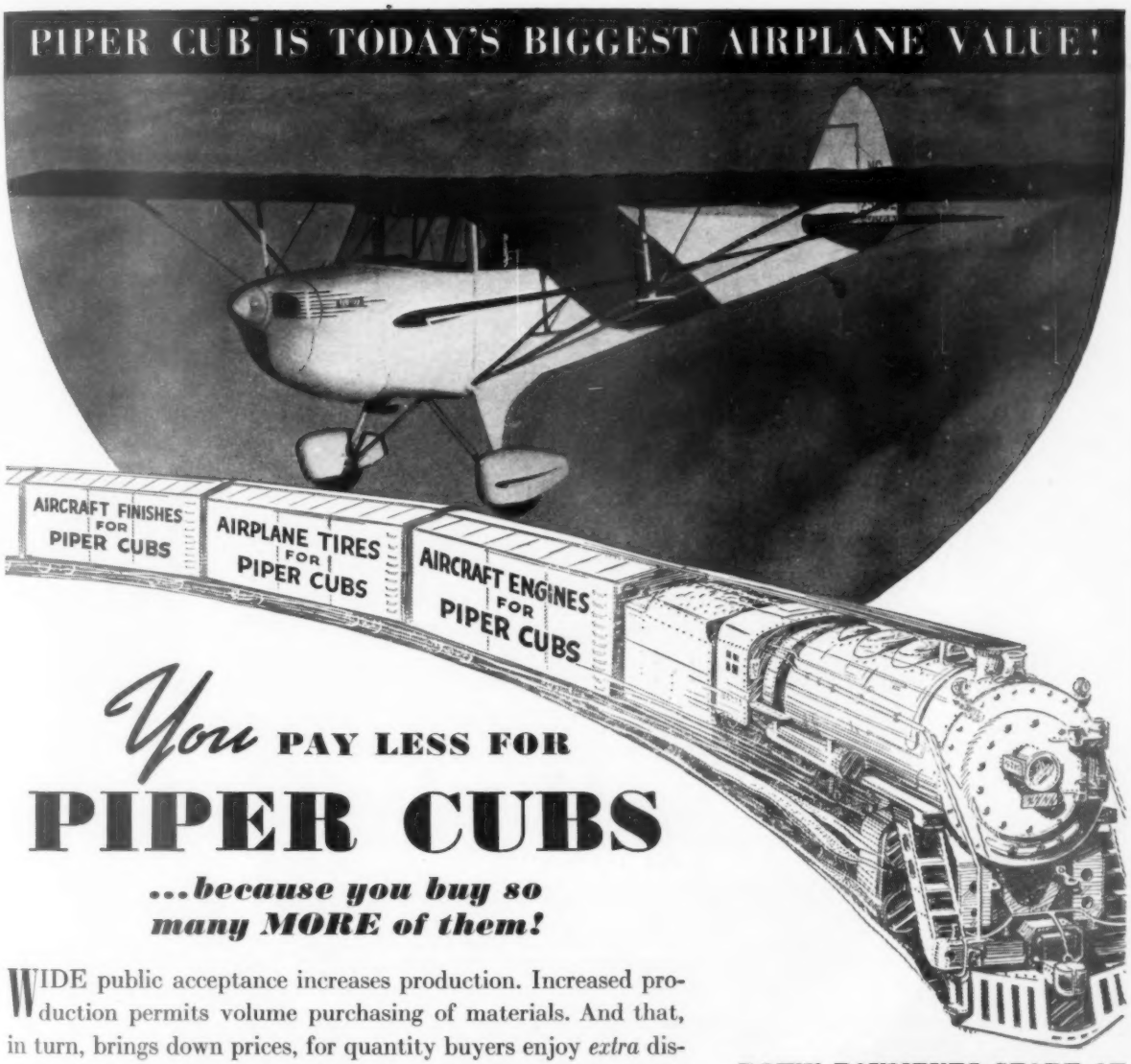

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(*Continued from page* 58)

within the cruising capabilities of the airplane; the gliding bomb, which has a device enabling an airplane to launch it at a distance of some miles from the target without passing over it; and last, the drop bomb, which requires that the aircraft employing it pass over the target.

I believe, therefore, that should Japan decide upon the reduction and seizure of the Hawaiian Islands, the following procedure would be adopted: A bombardment brigade of aircraft, consisting of 400 pursuit airplanes and 200 bombardment planes with the auxiliaries could be flown direct from Japan to Midway Island. The route along which these flew would be patrolled by submarine vessels or airships. Midway Island would be seized either directly by aircraft or by a surprise landing with the crews from submarines. We had an example somewhat resembling this during the last war, when a British submarine sent ashore a landing party in the Dardanelles and blew up a bridge.

As Midway Island is only 1,100 miles from Honolulu and there are intervening small islands all the way within 200 miles of each other—any of which could be used as airdromes and supplied by submarines or aircraft—the attack would be comparatively easy. The weapons used from the airplanes would be:

Mustard gas on water supplies.

Phosgene gas on airdromes, cantonments and navy yards.

High explosives on airdromes, naval fuel tanks and the city of Honolulu. (The use of high explosives against Honolulu to be combined with notice to evacuate it within four hours, when it would be subject to gas attack.)

There is no adequate defense against air attack except an air force. This can be supplemented by auxiliaries on the ground, such as cannon, machine guns and balloon barrages, but without air power these arrangements act only to give a false sense of security, such as the ostrich must feel when he hides his head in the sand. Our air forces in the European war lost less than one-tenth of one per cent from ground anti-aircraft defenses of all kinds. Furthermore, ground defenses can be easily neutralized, particularly if they are attempting to act independently and not attached to the air force.

Consider what an air attack such as has been described against Hawaii would mean, undefended as it is today with modern aircraft. And bear in mind that such attacks could be repeated at least three times a day unless stopped by an air force.

I have cited the landing on Midway Island to show what can be done, that instant communication with Japan is assured and that an aeronautical advance on Honolulu can be made immediately afterward. Once a permanent footing was obtained by an enemy on any of the islands, Oahu could be reduced by aeronautical seige and no amount of land power or sea power would be able to stop it, because aircraft would sink or destroy the surface ships as fast as they appeared. Even could aircraft carriers or transports reach the vicinity of the islands, they would have to establish themselves permanently on land in order to operate effectively.

If we desire to hold the Hawaiian Islands we must base our defense on an air force capable of covering effectively not only every inhabited island of the group but the string of reefs, small islands and shoals that extend from Oahu 1100 miles in the direction of Japan. Commercially, we must extend our airways all over the Pacific, both by airplane and airship.

The Philippine Islands are a source of strategical weakness to us, instead of strength. Japan is practically joined up to them by an airway through her islands which extend to one just south of Formosa, called Botel Tobago. That island is just 60 miles away from the northernmost island of the Philippine group. From there on is a continuous chain up to the Island of Luzon which contains the city of Manila. Commercially, we can trade with Asia without an armed base in the Far East, which was a necessity 30 years ago. Should we become involved in war with any Asiatic power, Alaska is closer than the Philippines to the vital points we would strike.

"Lem says they're collecting crash data."

The United States colonial policy does not contemplate exploiting either the people of the islands or their resources in a way that would militate against the well being of the inhabitants. So that economically there is not particular reason for the United States staying there. Politically, however, there is a decided reason. Should we evacuate the Philippines, they would be seized immediately by Japan. The people would be enslaved in the way that those of Korea and Formosa have been. The Japanese would then complete a system of airways and military depots along the islands blanketing Asia and would make a Japanese lake of the water between these islands, on which no commerce could move without their permission.

Our evacuation of the Philippines would mean the extinguishing of the Dutch Empire in the Far East, because the Japanese would immediately begin propaganda among the natives which would cause insurrections and serious trouble. This, in combination with Russian activities from the north, would probably lead eventually to an uprising of the people of India and a serious blow at the British Empire.

Therefore, the United States should keep the Philippines; but to sit down on the Philippines and attempt to defend them would lead to nothing. The best defense of the Philippines against the Japanese would be a direct attack against Japan from Alaska. The military policy of the United States in the Philippines therefore should be to maintain only sufficient military power to insure peace and tranquillity among the natives and to have small operating forces to use in the Asiatic theatre for the protection of American lives and property. To do more than this would lead to a useless waste of lives and treasure in case of war.

Outside of the United States proper, Alaska is our most important point with regard to our protection against Asia. The distance from Hawaii to Alaska is only 1,300 miles, as compared to 2,400 miles from our Pacific Coast. Alaska is within striking distance of any place we want to approach in Asia, either commercially or in a military way.

Little did Secretary Seward know how well he was building when he insisted that Alaska be purchased from the Russians. We were fortunate indeed to get is as cheaply as we did, that is, $7,400,000. The story as to how it was purchased has only recently become known, as it was never published for reasons of state. It seems that, before the Civil War, the Russians proposed that they sell us the territory of Alaska. They had just finished a war with Great Britain in the Crimea and were having a great deal of trouble over Alaska, because this province touched Canada and there was constant strife between the fur traders, the British Hudson Bay and Northwest Companies and the Russian-American companies. Russia thought that by interposing the United States between her Siberian possessions, she would be placing a neutral of tremendous military potentiality between themselves. She agreed to sell the territory to the United States for $1,200,000.

At this juncture the Civil War broke out and the hands of the United States were tied. No great nation of Europe was friendly to the Northern side, with the exception of Russia. We were on the point of war with Great Britain over the equiping of privateers in British ports for the Confederacy, and with France over the

(*Continued on page* 80)

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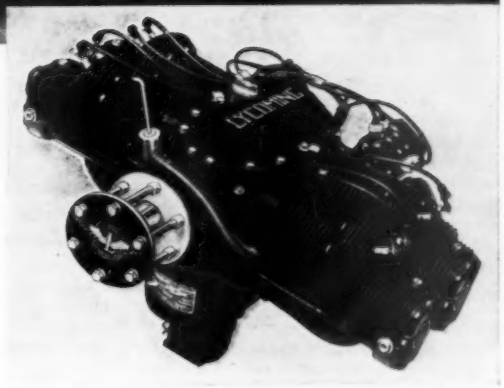

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FOR MILITARY AND CIVILIAN TRAINERS ★ FOR PRIVATE AND COMMERCIAL PLANES

Credit Takes Wings

(*Continued from page 36*)

fast contracts are returned by the airlines.

The industry generally is enthusiastic over the program. It is pointed out that many great markets have been opened by installment credit. Take, for instance, automobiles, they say.

"Would nearly so many automobiles be sold if it were not for financing plans?" they ask. And, the answer in all truthfulness must be: "No." The same applies to radios, to refrigerators, fur coats and to almost any item that can be thought of—installment selling definitely broadens the market for these items, so why not for air travel?

There's an interesting background to the airlines' plans and it illustrates the caution inherent in airline management explaining in part, perhaps, why the budding transport industry has managed to keep its head above water despite the many vicissitudes which have beset it during its progress.

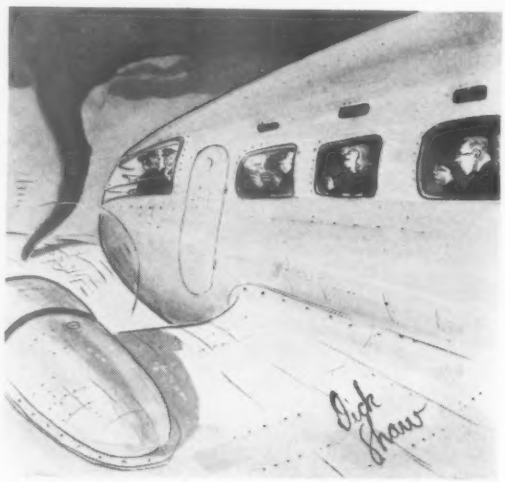
Nearly a year ago airline operators were approached by a group who proposed to form a new company—Travelers' Credit Corporation of St. Joseph, Mo.—and finance air travel. Walter S. Hillyard is the president of that corporation and executive vice president is Marshall R. Diggs, former comptroller of United States currency. After consideration and debate and despite the strong appeal held forth by the lure of tapping the mass transportation market, the airline people decided it would be better if the plan had a broader base. Consequently, they suggested that the railroads be approached on the idea. It was said that if the rails adopted the plan the airlines would come in, too. It was pointed out in this connection that if the plan had a broad base and was in general use, it undoubtedly could be adopted by the airlines at less overhead expense than if they were carrying it alone. Also, the fact that the plan was widely used would lend stability.

The railroads adopted the plan. On May 20, last, they announced a rail credit plan sponsored by Travelers' Credit Corporation. Airline executives kept a weather eye on the venture. They watched it spurt during the latter part of June and early July to widespread popularity and then—and not until then—did they start to get their feet wet.

At a conference late in July in Kansas City, Mo., a tentative contract was drawn up following negotiations with Travelers' Credit Corporation representatives. Terms to the airlines were made identical to those enjoyed by the railroads who, for the present and the near future at least, can be looked to for the bulk of installment travel. As a result, air travelers very soon may walk into any airline ticket office, travel bureau or tour agency, state where and when they want to go and go there with no money down and the entire cost spread over 12 monthly payments.

Mechanics of the plan are simple despite its revolutionary character and widespread ramifications. The way that it cuts down that imposing lump sum cost of a trip into twelve smaller sums is calculated to make air travel possible for countless thousands who heretofore have been under the shadow of the initial cash outlay.

Travelers' Credit Corporation is just what its name implies. It arranges for credit accommodations to travelers. Suppose you walk into an airline ticket office and state that you want to take a trip and pay for it in installments. The first thing the clerk will do is to figure out the cost of the proposed itinerary. Then he'll hand you a credit application blank which you will fill out on the spot. It takes only a minute or two. Within a short time, usually 24 to 48 hours, the okay will come through and tickets will be issued. If an all-expense tour is wanted—with side transportation, meals, hotel and sightseeing—that, too, will be financed on the same terms. The first payment would be due 30 days after the ticket was purchased.



"Hot darn! We're going to hit her right at the soup course."

That's what will be seen outside the ticket counter. Here's what's behind the scenes: After you hand in your signed application it is immediately forwarded to a local bank (more than 2,000 banks already have been signed up by Travelers' Credit). There a routine credit inquiry is conducted and if the applicant is adjudged capable of meeting the monthly payments, a check is returned to the airline covering the full cost of the trip. A service charge, varying according to locale, but usually running between seven and eight per cent, is made. This covers interest on the principal advanced by the bank and a service charge by Travelers' Credit. The latter applies its portion of the service charge to overhead expense, forms, promotion and advertising and to keeping credit channels (banks) lined up and clear. Monthly payments are not made to Travelers', but to the discounting bank. There's nothing else to it, no co-signers nor collateral is required.

Now let's see what installment credit opens up in the way of new flight opportunities. Starting with trips costing $50 or more (no trip costing less than that is financed), the first trip from the standpoint of numerical popularity is New York-Chicago. The round trip cost is $80.90. Add an eight per cent service charge for installment payments and this is raised to $87.37. On the basis of 12 equal monthly payments it will take $7.28 monthly to pay for the trip. A round trip from New York to Los Angeles will cost $24.29 monthly for 12 months.

More romantic, however, are the interesting possibilities for Mr. and Mrs. John Public to go to places on a two weeks' vacation—places which the cash outlay and the time element, if surface transportation were used, formerly made impractical. Pan American Airways, flying to colorful Mexico, Central and South America, offers interesting possibilities for installment credit flying. A Mexico City tour, starting at Brownsville, Tex., is listed at $114 for eight days. This includes hotels, meals, limousines and English-speaking guides, sight-seeing and other expenses. Added to the $114 would be the air fare to Brownsville. If Chicago were the starting point, the round trip would be $134.72. This totals to $248.72, or $22.39 monthly for a personalized tour of Mexico. Time, including flights between Brownsville and Chicago—10 days. A 56-day tour of Mexico, South and Central America, costing $1,690 per person if two go, can be sold at $164.23 monthly, including the round trip fare from Chicago to Brownsville.

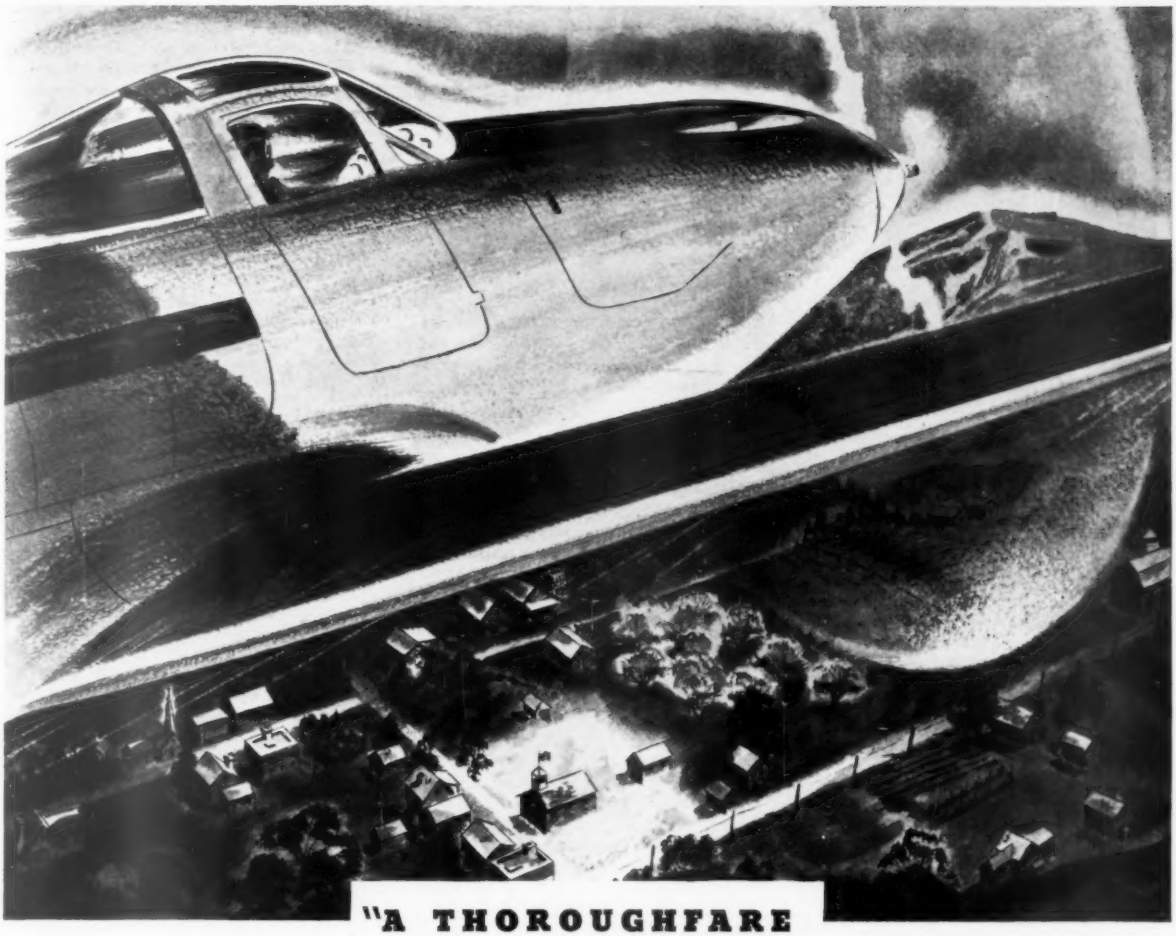
Less pretentious, but no less enjoyable, are the many all-expense tours offered by domestic airlines. Transcontinental & Western Air's "No. 3"—Chicago, Grand Canyon, Boulder City, Hollywood and all the trimming costs $363.97 or $32.76 monthly. United Air Lines has a similar trip in which Yellowstone Park is included. The cost is about the same. The time for these tours is calculated so as to just fit in the span of a two-weeks' vacation. American Airlines offers similar all-expense tours to New England, Niagara Falls or to the Southwest. Costs vary from $8.90 a month up to $30 plus.

So the next time you walk into an airline office don't be surprised when you see posters admonishing: "Go now! . . . No money down! . . . Pay later!" It's a good bet that within the next year a good many thousand installment-conscious Americans will take to the installment-conscious airlines to see America for the first time from the air.

END

Singers' Sons Fly

DENNIS King, Jr., son of the light opera singer, has signed up for a private pilot's course at Roosevelt Field, L. I., N. Y. Lawrence Tibbett, opera star, has conferred with Roosevelt Aviation School officials about a course for his son.



"A THOROUGHFARE FOR FREEDOM BEAT"

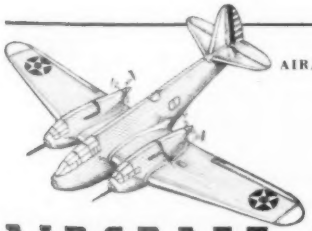
Day by day, almost hour by hour, America becomes to each one of us a dearer land. Pulses beat faster. Emotions are quickened. More and more poignantly we feel that from sea to shining sea, *this is our land.* Our land to love, and when the need comes, to defend.

No proud isolation guards our shores. Mere miles offer us no security. Clearly we see today that the barrier around America will henceforth be in its entirety the product of our own zealous handiwork.

In this country's program of protection the name Bell Aircraft assumes an ever-increasing significance. In countless ways Bell is cooperating with the nation's pilots in advancing the design, speed and efficiency of aircraft to strengthen our protective resources.

In production for the U. S. Army Air Corps is the Bell Airacobra. A plane of advanced design and superior performance, its mission is the effective interception and attack of hostile aircraft.

At Bell Aircraft, every idea, every tool of our ultra-modern plant is devoted to the ideal of defense. We are dedicated to the proposition of continued cooperation with the U. S. Army Air Corps and the Navy Bureau of Aeronautics in developing the most efficient means of preserving America, a free land, inviolate.



BELL

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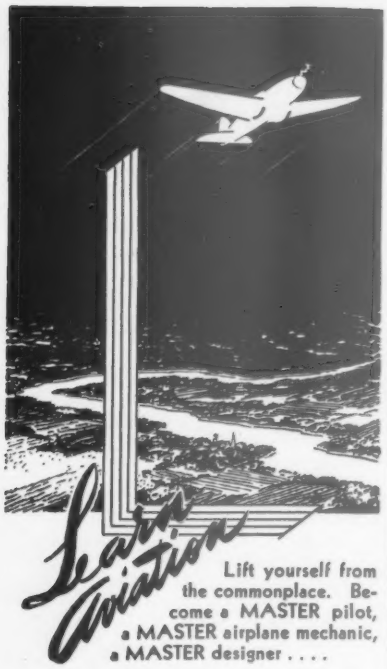

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"Photo by Groenhoff"

(*Continued from page 25*)

shoulder, Groenhoff looks like any young man spending his day off at the airport. But there's this exception: His eyes are slanted in a wise way and he seems anxious to catch every little detail of what he sees, every little variation of color, every intrinsic feature of the scene before him. What he sees he shows the world through the medium of his camera. He learned photography by shooting pictures, throwing them away and trying again. He had no tutors, no daily column of helpful hints for camera fiends. Spotting a picture has become an automatic reaction for him. Since his first professional efforts at photography in 1934, he has developed himself into the foremost aviation photographer in the country.

Don't confuse the work Hans Groenhoff does with that of an aerial photographer and don't make the tactical blunder of calling him a newscameraman. Groenhoff insists that he is simply an aviation photographer, which is a species distinct from any other brand of shutter snapper. He is not interested in making pictures of the ground from an airplane which is the function of an aerial photographer, nor is he after the spot news photos that appear in your daily newspaper. Quite simply, he makes the most striking pictures of airplanes and aviation subjects that have ever taken your breath away. His color pictures are in great demand and they are indisputably among the best that can be found in the aviation field.

He prefers to work without the aid of telephoto lenses which are widely used in aviation photography. He would rather fly within inches of another plane to get a good picture than to rely on the long range lenses which blur backgrounds. This policy has produced scores of smash pictures and—surprisingly—no smashed planes. He once took a picture of a plane that was flying in a tight circle around him while he stood on the ground and snapped the shutter. When the pictures were developed he found that the wing tip of the plane had been dragging in the grass. He was literally within an inch of death that time for the plane would have spun right into him had that wing touched the ground.

Groenhoff's real opportunity to break away from an office and devote himself completely to photography was given him by Frank Tichenor, publisher of *Aero Digest* and three other magazines. Tichenor had seen some of Hans' work and offered him a job as staff photographer for the publications. That was in 1937. The year he spent on that job brought Groenhoff not only widespread attention in the industry for his work but a chance to establish himself firmly in the business. He now owns three cameras: A Speed Graphic mounted in a windbreak box; a Fairchild Aerial which he seldom uses; an old Contax left him by his brother which he use frequently because of the speed with which lenses can be changed.

Most of his picture taking is done from the cockpits of airplanes. "I think I have flown in as many or more planes than any other person in the country," he says. Through special permission he has been allowed to fly in almost every type of U. S. Army craft; he has snapped pictures from all the lightplanes; and his wide acquaintanceship with aviation people across the country has enabled him to fly with them and take pictures on the way.

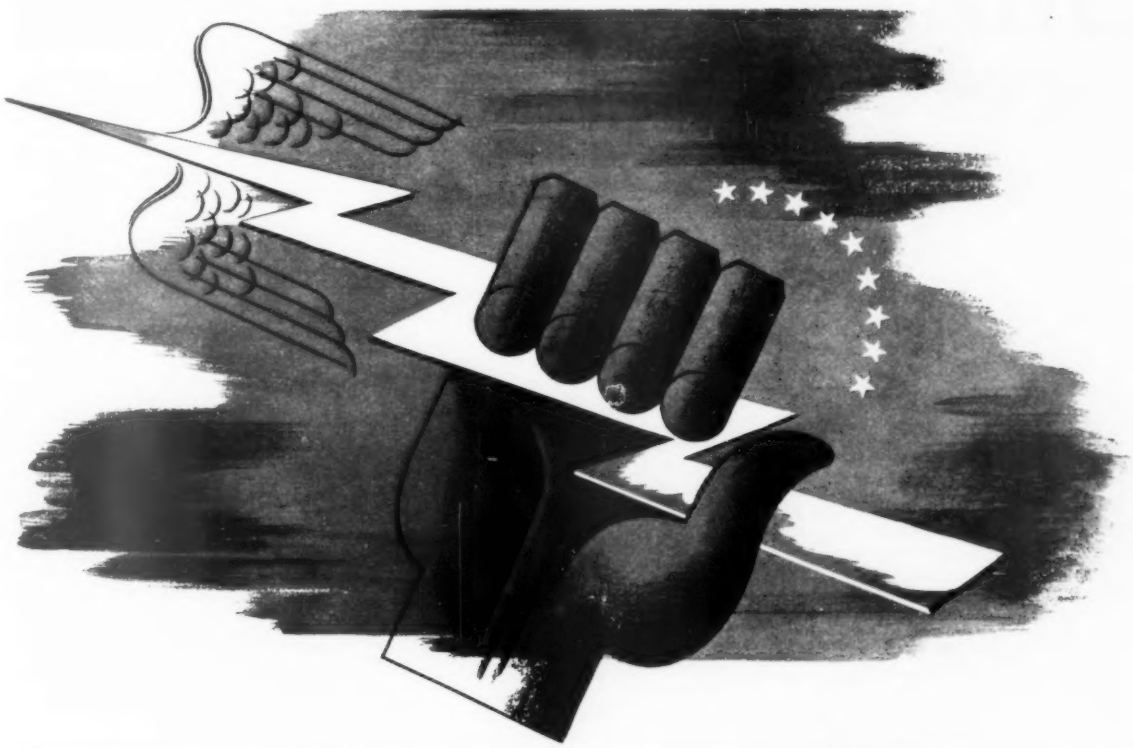
He once came out of a difficult maneuver to find that he had swallowed his tie. He hadn't noticed it in his mouth because he was so intent upon getting the pictures he wanted, riding backward in the rear gunner's seat of a fighter. "That plane was all over the sky," he recalled "and I have never had so harrowing a ride in my life. Don't let anybody tell you a gunner's lot is easy. You'll never know what confusion is until you have ridden rear end forward at high speed while the pilot does flip-flops."

All his adventures have not been amusing. He joined the lightplane cavalcade for the last two years on assignment for a magazine. During the 1939 trek the Florida weather caught him unawares and he came home with a prime case of the flu. A picture used in advertisements of Hamilton Standard propellers, showing a red, white and blue tipped prop revolving was made by Groenhoff. He took some pictures for the same company in an experimental cold room in which the temperature was 40 below zero. Hans wore a fleece-lined flying suit but no gloves. It took him a half-hour to get the picture and when he was done a thick coat of ice enveloped the camera and the film was frozen.

Since 1938 when he finished his work for Tichenor, Groenhoff has resisted all offers of permanent staff jobs. As a free lance, he sells pictures to airlines, magazines, gravure sections and manufacturers for use in advertisements. The orders for pictures roll in regularly and keep him busy. Backbone of his income is advertising and promotional work he does for manufacturers, but the most lucrative single source is special assignments for magazines. His income is subject to considerable variation because there is no predetermined scale of prices for pictures.

From a calendar on which he records aviation events, assignments, deadlines and ideas Groenhoff sets up a loose work schedule for himself. Like aviation itself, however, his business hinges on the vagaries of the weather. On almost any nice day, though, Hans goes to an airport and takes volumes of pictures. Gloomy days you can find him in the darkroom. And if he is working against a tight deadline, he will spend all day with the camera and all night with the developer.

Aerobatics are a common part of his routine and he is one photographer they seldom frighten. He works so intently to stage his pictures even when speeding 300 m.p.h that he doesn't have time for fear. But after the pictures are taken and the realization comes of what he has been through—he sometimes trembles like a plate of jelly on a three-legged table. Most exciting experience Hans can think of was riding a Douglas B-18 bomber to the big show the Army put on at Wright Field, Dayton, Ohio, last August. He occupied the nose seat from New York to Dayton while the ships flew in a tight formation on instruments part of the way. Because of the weather he didn't spend much time



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making pictures so his main pastime was watching the wing tips of the neighboring bombers fade and reappear through patches of clouds too close for comfort. This ride gave him a tremendous respect for the ability of our Air Corps pilots.

"Their accuracy and sureness is amazing," he said. "They are without question the best flyers I have ever seen even though I am still nursing goose bumps from that experience.

"When you write this story," he continued, "be sure to say that I consider the Army Air Corps not only the best group of pilots, but the most courteous and accommodating bunch of people with whom I have ever worked. For instance, I once wanted to get pictures of a squadron of P-36's flying in formation, peeling off and performing other maneuvers. They not only granted me permission to do this, but furnished a Northrop A-17 attack plane with two-way radio and a whole squadron of P-36's.

"Well, I couldn't understand what they said to me on the radio, but they took my orders all right. I put them through their complete routine and shot picture after picture. They did everything I asked with alacrity and I got a wonderful set of photos." Groenhoff doesn't say so, but it isn't every photographer who is given what amounts to *carte blanche* in portraying the Army's air arm. It is just another tribute to his ability and discretion.

Since he is busy most of the time making pictures for profit, Groenhoff hasn't entered many of his works in competition for prizes. In the New York apartment in which he and his wife live, you can nevertheless find a silver medal and certificate from Italy awarded for pictures he had on display there is an international exposition as well as scrolls awarded in the few other competitions in which his works have been entered.

He is still active in the glider movement and has not missed a major gliding meet since he came to this country. Occasionally he makes a trip to Elmira just for the pleasure of soaring and the extra-curricular fun of taking soaring pictures. Hans loves to fly and he loves to see others flying. Right now his only hobby that is divorced from his work is—lightplane flying. He is taking dual instruction now and says: "Some day maybe I'll own one. Boy! Won't that be something?"

Yes, that certainly will be something. And we won't be surprised if he moves his bed into a hangar some place so he won't ever have to leave the airport. Because that's the kind of guy he is.

END

Instruction from Ground

(*Continued from page 39*)

and have a new certificate made out to allow for the increased weight. This should be a matter of routine, if a certificated mechanic signs the form and the added weight does not exceed the load limits specified on the certificate.

When the students become accustomed to wearing the earphones they are enthusiastic about the set-up. And the instructors? Well, let's watch Joe Blank take-off for his last flight before the C.A.B. inspector checks him for his private license. There are two maneuvers he needs coaching on: Spot landings and spins. He takes-off and climbs to 3,000 feet for the first attempt at a two-turn precision spin. He pulls the nose way up, kicks rudder after the stall has been reached and falls off into a vicious spiral which is fast enough to tear the wings off. Ordinarily he would have climbed back up to try it again, probably to use exactly the same technique.

"Number Three from base," chirps the radio as the instructor broadcasts on the specially assigned frequency, "do not raise the nose so high. Apply rudder sooner." This time the ship enters the spin beautifully, spins once, twice—two and a half times! "Number Three, count your turns!" And the student does his two-turn spins solo in just about half the time it would have taken ordinarily.

Gliding down for his spot landings Joe Blank manages to avoid collision with another plane primarily because the alert instructor at the microphone below has broadcast a warning to them. Finally getting into position, Joe cuts his throttle back at an altitude of 800 feet over the spot. The wind immediately causes him to drift off his pattern and in his anxiety to turn back toward the spot, Joe executes a steep turn with his nose high in the air, finishing with the well-known but unpopular graveyard glide. Now on the second or adjusting leg, the instructor tries a little coaching.

"Watch the drift—your wind is stronger today. Keep the glide constant." Not very much—just enough coaching but not too much. The instructor avoids the ever-present evil of over-instruction. As he watches Joe come in, nose still too high and with the gliding speed becoming slower every second, it is apparent that something is wrong—something is lacking. Ordinarily the entire half or three-quarters of an hour would have been wasted because it would have been difficult if not impossible to have recalled Joe. But now: "Base radio to Number Three: Report to your instructor immediately." The plane lands bumpily short of the spot and taxis obediently to the parking area where some psychological inflation (or deflation, as the case may be) is substituted—whatever it may be, greater efficiency and a quicker grasp of the day's work will result.

Simple? Yes, and effective, too. The saving in time, the increase in efficient operation (especially with crowded programs, limited daylight hours and increasing traffic conditions) signify that a new era in lightplane operation is here. Controlled solo instruction is the word—not mere solo flying, but directed practice, rapid learning, prompt correction of mistakes. And not least—greater safety from wind changes, poor technique and traffic hazards.

When the student is finally considered ready for check flight he has greater confidence in his ability to pass the test. His training has been more thorough and his solo hours have consisted of directed practice, which means that his mental outlook will be in his favor. Maybe that is exactly what he needed to conquer that old, familiar hazard—inspector-itus!

END

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Vultee Expands

VULTEE Aircraft, Inc., Downey, Calif., has completed the first part of a major plant expansion program which will cost approximately $2,900,000, including equipment. Total floor area when the program is completed will be 802,000 square feet, an increase of 142 per cent over the previous 331,000 square feet. Vultee is working two 58-hour shifts a week and is employing over 3,500 people.

With the R.A.F.

JOHN C. Cox and George Smith, Boeing School of Aeronautics graduates from Canada, are now on active service with the R.A.F.

HOW TO RENT A PLANE

YOU can now rent a perfectly conditioned airplane in a matter of minutes . . . at prices ranging from $8.00 an hour . . . and pay only for time in the air! Choose any ship that suits your purpose . . . a light plane for a leisurely and economical pleasure hop, a speedy comfortable ship for cross-country travel. Aeroncas, Stinson 105's, Bellanca Cruisairs, Fairchild 24's, Harlows, Waco Standards and Customs, the sensational new Ercoupe with tricycle landing gear . . . the Ailor Fly-Ur-Self System has them all, completely equipped with blind flying instruments, two way radio, and direction finders, some of them automatic.

1. Less than two minutes to fill out this form. The Ailor Fly-Ur-Self System agrees to protect pilot, passenger and plane against all liabilities. Nothing for you to concern yourself about on that score! Gasoline and oil are included in the hourly rental rates. Private owner worries . . . maintenance, periodic check, depreciation . . . are all on the house.

2. An automatic clock records your time in the air. No need to bother with a split-second log while this fool-proof gadget is on the job. It operates only when you fly and that's all the time you pay for. You can keep the ship a day, a week or a month. The daily minimum begins at an hour and a quarter. You'll average that easily on any kind of trip.

3. One minute for the chief dispatcher to put the timer in your ship. When you return from your business or pleasure jaunt, the automatic device will provide you with an immediate and accurate flight log. For students seeking radio, instrument or cross-country experience, a check pilot is always available at a fee in keeping with our low-cost-of-flying policy.

4. In less than 5 minutes, you're off wherever you want to go without a worry in the world. Simple, isn't it? Hundreds of flyers are already taking advantage of this marvelous new convenience, one that aviation has needed for the last ten years. Visit our hangar at Roosevelt Field and inspect the Fly-Ur-Self fleet. *Fly the revolutionary new Ercoupe!*

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Modern Veteran

(*Continued from page 46*)

which so many aviators learned to fly. Clumsy, awkward, underpowered, too heavy a crate the "Jenny" was, but a fine ship for its day and many a flyer thinks back longingly to the staunch old ship. Here at Buffalo Depew took a "refresher" course in a "Jenny."

Then in 1917 Depew was sent by the Curtiss company to the Second Officers Training Camp at Plattsburg, N. Y., on an aerial photographic mission for the Army. Finishing that, he was assigned by the Curtiss company as a civilian instructor at Newport News, Va., and Miami, Fla., teaching a lot of military flyers some of whom achieved much distinction in the war.

In 1918 The Curtiss company recalled Depew to Buffalo to become a test pilot at the factory. The first regular air mail line, the route between New York and Washington, was projected and Curtiss got the job of building the first mail planes, Hispano-Suiza motored "Jennies." Depew got the job of test flying these ships just a few days before the deadline for delivering them. Thus Depew became the first man to fly a U. S. government air mail plane, although not on a mail route.

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And the Curtiss company got in under the wire only by the skin of its teeth.

"What a job one of those Jennies was," Depew recalls. "Specifications were that they'd have to do 90 m.p.h. They did it too — 90.3 m.p.h. A pretty close shave. Sweet ships those Jennies with their big 150 h. p. Hisso engines—or so we thought then for we were used to Jennies with OX-5 engines, a trifling 90 h. p.

"Today a 65-h. p. Taylorcraft will do everything those Jennies would do with 150 h. p.—plus a lot of other things. It will carry as big a load, get out of a smaller field, stay in the air longer—and run away from it—and it costs only a small fraction of what such a Jenny cost."

Later in 1918 Depew was commissioned a captain in the U. S. Army and was sent to McCook Field, Dayton, Ohio, as a test pilot flying planes powered with bulky Liberty engines, trying to break down the engines and the spark plugs to help to work out the "bugs."

"Well we broke down the spark plugs," he said, "but what we did to those engines was nothing short of a crime. But it helped to make better spark plugs and safer, more reliable and more economical engines."

Leaving the army Depew returned to the Curtiss company as a test pilot, later a flying instructor, manager of the Curtiss school at Mineola, N. Y., and then manager of Curtiss Field which later became known as Roosevelt Field. In 1922 he went to Argentina as the Curtiss Airplane Export Corporation's manager of sales and operations. In 1923 he returned to the United States, joining Fairchild Aviation Corporation and he has had connections with Fairchild ever since. He served it and affiliated companies for many years in various jobs—chief pilot, manager of the flying division, sales engineer, test pilot, vice president and director of the Fairchild Flying Corporation, sales engineer and sales manager of the Fairchild Airplane Manufacturing Corporation and later sales engineer of the American Airplane & Engine Corporation.

He sold tremendous quantities of flying equipment to the airlines during those years frequently being called in as a consultant to help determine their flying equipment needs. Depew then became vice president and manager of the famous Aviation Country Club of Long Island at Hicksville, N. Y., and later, with Beckwith Havens who also learned to fly in 1911 was for four years Fairchild airplane distributor for the northeastern United States. He joined the Taylorcraft corporation about two years ago when Fairchild bought into it. And Depew has had increased experiences. For example, his initiation into the Caterpillar Club.

Flying a big lumbering Fairchild "71," a seven-place *Wasp*-engined job, to Pittsburgh in 1929, Depew suddenly found himself flying blind and without blind flight instruments over the rugged Pennsylvania mountains. For 20 minutes he flew by "the seat of his pants." Suddenly the big ship fell off into a power spin or a steep power spiral. Depew fought desperately to bring the ship out while his single passenger sat rigid, white-faced. The big ship gained terrific speed far in excess of its normal safe speed. With a sharp crack the right aileron control gave way. The control stick suddenly gone berserk flailed his knees.

"Jump!" screamed Depew above the shrill wailing of the air around the strained struts. The passenger, equipped with a parachute, loosened his safety belt, fought open the cabin door against the pressure of the air stream then disappeared. A second later Depew's camera floated lightly out of pocket, drifted about the cabin then disappeared out an open window. Depew forced his way out of the spinning ship opening his 'chute when he was well free and landed on a rough mountain road. A second later he heard the ship crash into trees nearby. Gathering up his 'chute Depew started down the road and finally met a hearse. Depew attempted to flag down the machine.

"Out of my way, mister," shouted the hearse driver. "I'm looking for a couple of fool aviators who just got killed.

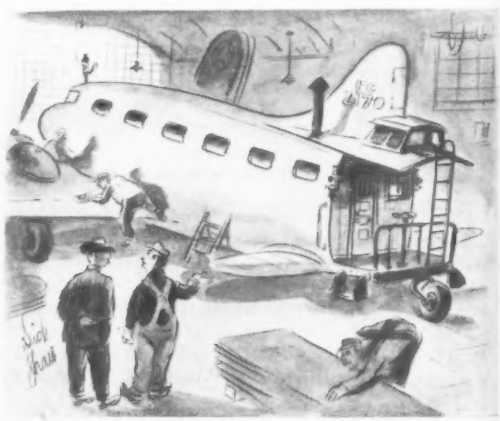
"And," he added, chuckling, "it ought to be a nice piece of business."

"I'm one of your fool aviators," replied Depew. "Pick me up."

An hour later, Depew and the hearse driver located Depew's passenger at a nearby farm house.

"Oh boy," the passenger greeted Depew joyously. "We're in the club. We're in the Caterpillar Club." But Depew wasn't so enthusiastic — particularly when he found the fine big "71" a crumpled, shapeless mass of twisted tubing, fabric and battered engine.

While flying a photographic ship on an aerial mapping survey over New Jersey to plan a route for a high tension power transmission line Depew had another narrow escape. At about 10,000 feet over Lake Hopatcong and 70 miles from his Mineola base Depew suddenly felt the ship lurch drunkenly. Closing the throttle he inspected the ship as carefully as he



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- ☐ Aircraft Factory Mechanic

(7)

could from his cockpit and found a bolt in the tail assembly had snapped. It threatened momentarily to come apart letting the tail blow away. But for now the tail group held together.

Deciding against jumping with his 'chute, Depew eased the ship around in a gingery turn and headed back for Mineola using a minimum of power and speed. Finally the Mineola Field hove into sight and Depew brought the ship down to the gentlest landing of his career.

"You, you . . ." sputtered the photographer, Robert A. Smith, still employed by Fairchild, as he climbed out of his cockpit, unaware of the accident. "Perfect weather," he exploded, "good air conditions . . . and then you give up the job. Why did you turn back?"

He quickly subsided when he saw the twisted tail assembly.

Now Depew has abandoned much of his active flying devoting most of his time to his executive duties although he still holds a commercial pilot's certificate and frequently takes a Taylorcraft aloft.

"But," he explains, "the old days in aviation are gone. And the new day with a much safer, much cheaper, much more reliable, much more economical plane is here—and it's our job to make and sell it. It's our job also to make the public realize aviation's place in the scheme of things and to accept it."

Depew finds plenty to do in keeping the Taylorcraft plant humming. At Alliance, Taylorcraft Aviation has a fine big single-story brick building—the original home of the ill-fated Argo biplane and the Hess *Warrior* engine—which is jammed to overflowing with machinery, equipment and more than 200 workmen who are busy turning out about 15 Taylorcrafts a week under Depew's direction.

"And if this keeps up," Depew comments jubilantly, "We're going to need more room—a lot more room—for the old days in aviation are gone."

END

Aviation's Apostle

(*Continued from page 37*)

once in 17 months has Williams missed a speaking engagement. He's proud of that record, for as he says: "I think it speaks in broad terms for the safety and punctuality of private flying."

The speaking formula of aviation's apostle is simplicity itself. No arm waving, no crescendos to carry a point mark his actions. He speaks quietly, expressively, leavening his speech flow with a flash of humor here and there to take the sting out of some of the things he says about local aviation problems. Prior to his talk he discusses airport problems with civic leaders. If the town is amiss in keeping up with the parade the Colonel tells them so bluntly. Clippings received by *Reader's Digest* in Pleasantville, N. Y., indicate folks welcome the chance to discuss their problems with a fellow who knows the answers from experience.

At the conclusion of his address the flyer offers to take aloft those in the audience who have never flown. Lots of die-hards fall under the fascination of his words. He has carried 3,400 first flyers, has logged 360 hours and 41,000 miles doing it. Each first flyer gets an attractive card on which is placed the date and message that "this passenger actually handled the controls of the ship while aloft." Hundreds of first fliers would rather cut off their right arms than part with one of Williams' cards. A number have indicated, after hearing and flying with Williams, they intended to learn to fly. It's difficult for *Reader's Digest* to follow through and find out how many actually do, but several cases have been found. Many write asking for the Colonel's advice on how to get into various phases of the aviation industry. One Oklahoma community reported four of the wealthiest men in town went right out and bought a chunk of land for an airport after hearing Williams speak. The major airlines and the C. A. B. shouted approval when they heard of the program.

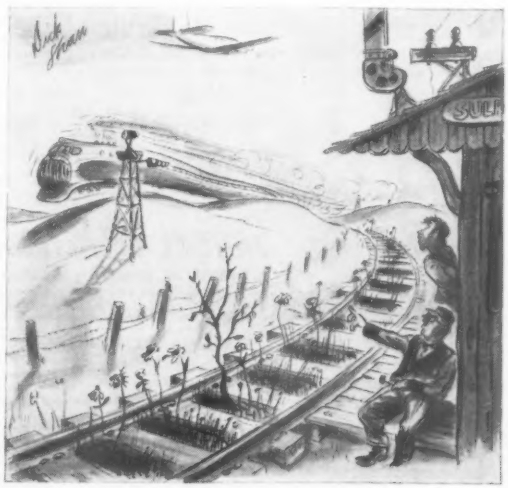
How has the Colonel gone over? Well, 126 cities have asked for a return engagements, but, of course, have been refused. Some of the things Williams says are surprising even to men in the industry. First, he says what keeps so many people out of the air today is fear—not fear of injury—but fear of criticism. "You know the airlines flew 841,000,000 miles last year without a fatal accident, but you're afraid of what people will think and say if you travel on them," he says pointedly. A second form of criticism he talks about is the mental barrier put up by antiquated businessmen who yell the battle cry: "You'll never get me to ride in one of them things. They're for fools only." What employe has the courage to travel by air or learn to fly when the boss blows up every time "airplane" is mentioned?

The Colonel pleads for a better understanding of aviation by parents of growing boys. Learn about it, he begs, so you can be a qualified guide for your boy when he asks your advice about entering it as a profession. Don't stick your head down the hole of ignorance and shout "no." Youngsters want to fly. That's backed up by a *Reader's Digest* survey. Says Williams: "Of 200,000 school children contacted, we found 60 to 75 per cent already had been in the air; 60 to 75 per cent had built model planes and the majority indicated a decided preference for aviation as a career." In most cases, the survey found, parental objections stopped the career in the bud.

When Williams speaks of the movies he gets a little aroused.

"Hair-raising crack-ups and death every reel are enough to frighten anybody," he comes his closest to shouting. "It's no wonder parents want their children kept away from flying as the movies dish it out." But he points out that this is not the real aviation. For the real thing is a business—a constantly growing beehive demanding thousands of new bees every year to keep it humming.

"For every man in the air today it takes 17 on the ground," he declares. "Aviation



"Now they're traveling the beam!"

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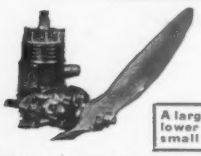

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is an integrated industry of 150 separate trades, employing some 200,000 persons. It will need two or three millions more in the next few years so rapid is its growth—and these two or three millions are going to be made up of your son and mine."

Then his address reaches the smash wallop—the story of his flight to Rome. It's a graphic word picture, painted on a canvas of trials and dangers that beset him and his navigator, Leon Yancey, as they plowed on hour after hour in zero-zero weather. Yancey, whose humorous notes the Colonel gives credit for keeping him going long after hope had gone, died last April.

Reader's Digest has been swamped by letters of congratulation on its innovation. Club leaders, sponsoring groups and individuals have penned their approbation.

Colonel Williams first hit the nation's headlines in 1928 with the transatlantic flight, but his aviation career began long before that in Stratford, Conn. It was in 1913 that a young lad became what was then, and undoubtedly still is, the first test pilot to fly his solo and test hops at one and the same time.

Stanley Beach, aviation pioneer, was building a new experimenal plane. Young Williams hung around, helping out here and there. There was much bickering between Beach and some of the other interested parties. This verbal feuding reached a climax over a test pilot, both factions having a candidate. Beach lost his temper, yelled: "I'm financing the blasted thing and I'll pick the guy to fly it." He looked at Williams. "You're my test pilot," he bellowed.

The "test pilot" spent many days just taxiing the plane around the field. He knew he didn't know how to fly it and doubted that he had the courage. So he taxiied only during the early morning when there was no wind. One day he bent a wheel. By the time he had repaired it a light breeze had sprung up. But Williams failed to notice it and continued his slow rolling around. A sudden gust caught the plane and—he was flying. The subsequent harried landing smashed a wing tip and the propeller, but Beach was so tickled that the plane would fly he kept the "test pilot" who finally got so he brought the ship down in one piece consistently.

From that rather dubious beginning the Colonel has rolled up 15,000 hours in the air, has flown 69,000 passengers and has taught 700 persons to fly—none of whom has subsequently died in a crash. The apostle of aviation has some very definite and conceded to be radical ideas about how flying should be taught. He has watched and checked and studied through the years as he handled students with the result he is now trying to interest the C.A.B. in a psychological teaching method. It is his contention that every person, being an individual type, is amenable to a teaching pattern which must be matched to his physical, nervous and mental make-up. He places character types in four categories—mental, motive, vital and natural, the latter a combination of mental and motive.

"Each of these types has a different learning pattern, must be taught in a different manner," he say. "You can tell within a few minutes just what type your student is. Before you know it you'll be categorizing your man and fitting him into your corrected category. Do this and amaze yourself with the speed your students show generally."

The *Reader's Digest* tour is over and the Colonel is back behind that drawing board. He has designs just about completed for some of the most radical planes yet produced. The apple of his eye is one which he says is going to solve the problem of keeping the private flyer out of trouble when he makes a fool of himself aloft. But don't ask him for details. He's remarkably close-mouthed for a speaker.

END

Safe Training

(*Continued from page* 46)

the bonus lets you know that your efforts are appreciated."

The bonus system, however, has one major drawback, Eldred learned. It makes the instructors overly cautious—they washed out flying on days of unfavorable weather when Eldred felt it could go on safely.

As a result of the plan's success Eldred has worked out a new bonus system for his civilian pilot training program classes under which his two instructors now have 15 students each. Instead of paying a bonus for safety alone, he has set up a system to pay a bonus for safety, economy and speed. Now, instead of paying the instructors salaries, he allows each a drawing account. Each instructor gets $2 an hour for each hour his C.A.B. students fly—up to 35 hours—whether dual or solo, with a $15 bonus for each student who finishes the course within the allowed 35 hours without breakage and before the deadline set by the C.A.B.

"You may be sure that the instructors are seeing to it that the students are flying safely," observed Eldred, "that the students are getting in all the dual time they need and that the students are coming out for their lessons at the scheduled times—and aren't playing 'hookey' occasionally." He pointed out that each instructor will get, for each student he finishes up on time without any damage, $85 or $1,275 for about two and a half months work with 15 students, plus the pay he earns from carrying passengers or teaching private students.

"That's as good as airline pay," Eldred declared, "but the instructors ought to be paid well. Their jobs are as important as airline jobs and the pay ought to be as good. And if they do their jobs conscientiously, it's good for me, too, because it eliminates these trifling accidents, the $50 or $100 breakages, that soon take the profit out of instruction for the operators and runs up the cost of flying to the private student." The plan also is very successful in still another way, Eldred feels. "It's turning out better pilots," he said.

END

Mass Delivery

TWENTY private pilots flew as many Taylorcrafts from the company's Alliance, Ohio, factory to Los Angeles, a distance of 2,500 miles, recently. The planes were distributed for use in C.A.B. courses at the University of Southern California, U.C.L.A., Loyola University, San Bernardino Junior College, Santa Ana Junior College, Pomona College and Pacific Aeronautical College. Pilots making the mass flight included Alex T. Powell, Los Angeles business man who received his license on his 61st birthday.

Washouts Drop

PRIMARY training washouts usually average 40 per cent of each class, but a recent detachment trained at the Cal-Aero Academy, Glendale, Cal., and sent on to the Army's basic stage at Randolph Field had less than nine per cent of the original enrollment eliminated.

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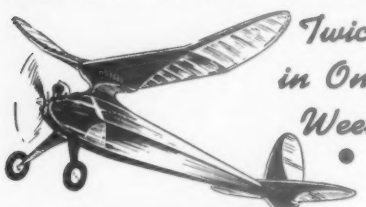

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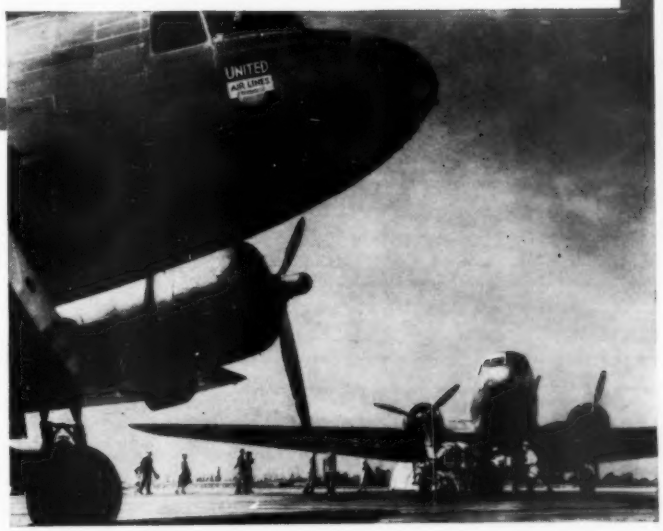

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BOEING SCHOOL OF AERONAUTICS

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Aero Fuels

(*Continued from page* 50)

years! Chemical synthesis of petroleum is still in its infancy and there seems little indication that the research workers intend to rest on their laurels. In fact oil company appropriations for such experimentation and development of new products are increasing by millions of dollars every year.

Another characteristic of growing importance is the volatility of an aviation gasoline. As it was brought out in the September issue of FLYING AND POPULAR AVIATION, a variation of combustion conditions frequently will give somewhat different results in use. Available evidence indicates that fuel blends which are equal during the take-off may not give the same performance when cruising on a lean mixture. Specific heat is not important at the take-off and a fuel of low rating may be used which may be unsatisfactory for cruising purposes.

Specification of composition as well as octane number is the safest method of ordering these high anti-knock fuels at the present time. Incidentally, the increase in octane number and lead susceptibility frequently accompanying increase in vapor pressure in ordinary gasolines are not usually related functions in the synthetic fuels.

One of the problems which has been facing refinery research workers in the past few years is the production of low volatility fuels for aviation use. In order to obtain satisfactory distribution of fuel between the cylinders a more volatile fuel is generally required for aviation than for automotive purposes. The fuel in the carburetors of an aircraft engine may fall to —50° C. or below when at high altitudes. The low temperature is due in part to the cooling effect of the evaporating fuel analogous to the cooling effect of alcohol or ether evaporating from the human skin. Aero fuel of petroleum base is fluid down to —60° C., but benzol, occasionally used as a blending agent to raise the anti-knock value a few points, solidifies from about —10° C. so that more than 20 per cent of benzol cannot be added without raising the freezing point above —50° C. at which point it begins to form solid crystals. Benzol also helps to dissolve small amounts of water in the fuel which freeze at low temperatures and may partially block the fuel filters and carburetor jets.

Vapor pressure must be low, preferably below eight pounds per square inch Reid at 100° F., especially for fuels to be used at high altitudes, in order to avoid stalling the engine by gas lock in the fuel system. Tendency to operate aircraft at maximum altitudes has been increasing and substratosphere navigation between 20,000 and 25,000 feet has become feasible. The decrease in atmospheric pressure incident to increased altitudes tends to cause more rapid vaporization which in turn means loss of the highest octane number fractions in the fuel as well as increasing the fire hazard. Considerable experimentation and development work has been done in the preparation of such aviation gasolines while adaptation of Diesel power to aeroplanes has revived widespread interest in the use of less volatile fuel in spark ignition engines. Three so-called Safety Fuels have been developed to meet this military and commercial demand and their use is now a very active aviation fuel project. Originally developed at the instigation of U. S. Navy engineers for use in lighter-than-air craft, Safety Fuel No. 1 has been in semi-commercial production for a number of years. A comparison of these Safety Fuels and regular aviation gasoline is given in the accompanying table and the data indicate that No. 3 is superior in every respect. With a suitable fuel system this product probably could be used in the most efficient engines developed to date without any apparent decrease in power or increase in specific fuel consumption.

A. E. Robertson of Standard Oil Development Company believes the whole question of fuels for high altitude flying might be summed up by concluding that from the standpoint of freedom from vapor lock and evaporation losses, it will be necessary either to provide special cooling devices with the regular aviation gasoline or to use less volatile fuels. In case the latter alternative is adopted, Safety Fuels are particularly advantageous since they assure trouble-free operation in this respect and offer a minimum fire hazard as well.

Safety Fuels will compete for the raw materials now being used for manufacture of high-test gasolines, but the demand for Safety Fuel, as it arises, may result in the development of processes which are basically new. They will have a lower octane number than blending agents of normal volatility produced from the same feed stock, but can be expected to lie between 85 and 100 octane and may go higher because of the good lead susceptibility.

It appears that Safety Fuels can be made available in substantial quantities by existing equipment and their price will depend upon the specifications which finally are accepted and upon the requirements of the consumers.

If progress in aviation develops along lines which dictate the use of safety-type fuels there is every reason to believe that, judging from the previous history of the petroleum industry, adequate supplies of Safety Fuels will be made available. Limitation of specifications to the least possible number of grades would permit major economies and the benefits will accrue to the aviation industry by way of low purchase prices.

Comparison of Inspection Data on Safety Fuels and Regular Aviation Gasoline*

Fuel	S.F. No. 1	S.F. No. 2	S.F. No. 3	Regular
Octane Number—				
A. S. T. M. Clear	88	81	....	74
A. S. T. M. + 3cc. T. E. L. (1200 r.p.m. 330° F. Jacket Temperature)	92	95	....	87
U. S. Army, Clear	93	77	88	90
U.S. Army + 3cc. T.E.L.	99.5	94	106	90
A. S. T. M. Distillation—				
Initial Boiling Point	310° F.	305° F.	235° F.	110° F.
10 percent at	330° F.	323° F.	275° F	146° F.
50 percent at	345° F.	348° F.	345° F.	187° F.
90 percent at	375° F.	372° F.	350° F.	234° F.
Final Boiling Point	400° F.	401° F.	358° F.	274° F.
Viscosity—				
Centistokes at 100° F.	0.886	1.425	1.550	0.562
Thermal at 60° F., secs.	212	285	....	145
Freezing Point	——	Less than —76° F.		——
Flash Point (Closed Cup)	105° F.	90° F.	95° F.	—10°F.
Gravity, ° A. P. I.	30	56.6	53.6	65
Reid Vapor Pressure, Lb. per sq. in.	0	0	0.2	7.0
Acid Heat	3° F.	1° F.	3° F.	1° F.
Sulphur, percent	0.026	0.016	0.26	0.10
Aniline Point	—30° F	181° F.	183° F.	122° F
Heat of Combustion—				
B.T.U. per lb. (High)	18,667	20,200	20,230	20,480
B.T.U. per lb. (Low, approx.)	17,700	18,760	18,800	19,100
Heat of Vaporization				
B. T. U. per lb.	130	120	118	146

*After T. E. Robertson, Standard Oil Development Company

END

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1939	1940	Per cent increase
34,457,270	55,234,672	60.29
31,046,932	53,025,818	70.78
44,441,846	73,096,779	64.48
47,423,868	79,885,146	68.45
57,407,080	90,662,538	57.93
63,576,325	101,172,222	59.14
278,353,321	453,077,175	62.77

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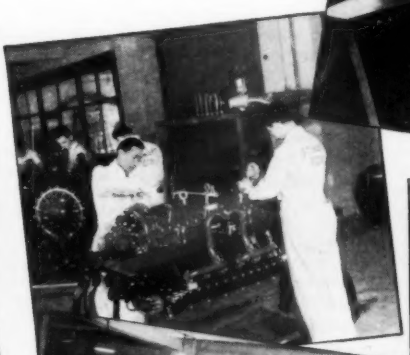

Aerodynamics

(*Continued from page 53*)

ward at that speed. Streamlining the disc reduces the resistance to 1.04 pounds and to .273 h.p. This great saving indicates that all non-lifting parts should be retracted or concealed and that the tendency is toward the all-wing airplanes.

In Section 5 a sketch shows how the air adheres to a surface for a certain distance. The thickness of the layer that does not move with the outside speed is called the "boundary layer." Measurement in wind tunnels showed that at 100 m.p.h. the layer is less than 1/1000 of an inch thick. This makes it imperative to have a highly polished wing surface for high speed planes. The reduction of the "wetted" area leads to small fuselages and shorter pilots and to use of parts of the fuselage for fin area. The size of the object greatly influences the direct resistance and the frictional resistance. Two spheres of different sizes (Section 5) are in the same airstream. The inertia forces are similar to the centrifugal force and therefore are in direct function to the square of the speed and indirectly proportional to the size (r). The Greek letter ρ in the equation is the density of the air. The frictional forces are directly proportional to the speed and indirectly proportional to the size (r). The Greek letter μ denotes the viscosity. Dividing the inertia force by the frictional force gives the kinetic viscosity or the Reynolds number.

There are a few theories of the airflow over an airfoil. The momentum theory, circulation theory, induced drag theory, vortex theory or the general hydrodynamic theory. The result, however, will be the same equations. Forming an object so that it follows the streamlines will have no resistance if the frictional forces are discounted (Section 6). Curving this body should give no lift; even if part of the section is used as sketched in Section 6.

Diagrams in Section 7 indicate the acceleration and speeds over a non-lifting section on which all forces are balanced. Since there is an increased pressure below and a decreased pressure above the airfoil, a flow will arise around the wing tip and at the trailing edge as illustrated in Section 8. They are called the "vortex ribbon" and cause the downwash. Adding the downwash to the diagram in Section 7 will result in the diagram in Section 9. The downward flow of the air past an airplane creates a certain pressure on the surface of the earth. The pressure is very low and calculable, using the equation noted in Section 10.

Section 11 shows the conception of the airflow in order to formulate the circulation theory. The upper sketch shows the translatory flow, the next one the circulation around an airfoil and the combination of both in the lower sketch. Much simpler is the layout in Section 12. The lower sketch in Section 12 shows how this circulation is started by the trailing edge vortices. Their actual presence has been proved by photographs. At some speeds vortices leaving a body follow at regular intervals. In super-imposed position they are unstable (Section 13). In staggered position they are stable and located at a certain distance. With certain assumptions the resistance of the body lying ahead may be calculated from the position of the vortices.

The simplest of all theories is the momentum theory that uses the law of physics according to which the forces equal to the accelerated mass of air and the lift of an airfoil are equal to the downward momentum of the mass of air as sketched in Section 14. The deflected air creates a drag force called the induced drag. This force is a function of the aspect ratio, the ratio of the span and the average chord. A few formulae are given in Section 15.

To cut down tip vortices tapered wings are used. Tests on airfoils showed that in some instances the decrease of the chord will increase the drag. In Section 16 a specific example illustrates this problem. The upper diagram shows the variation of the profile drag with increase of chord. If section A of the wing is located on the diagram the decrease of the chord will increase the profile drag. The increase may be greater than the added tip vortices of the cut-off wing. The pointed wing tips may be also detrimental in cloth-covered airfoils or in airplane models because sagging at the tip distorts the airfoil section.

In Section 17 the upper diagram shows the plotting of the drag and lift coefficients of an airfoil. The curve drawn from the zero line is the calculated induced drag. The difference of the total drag and the induced drag is the profile drag, usually the minimum drag of the wing. The lower diagram shows the plotting of the profile drag against the lift coefficients. This diagram is used in selecting a suitable wing section. First the lift coefficient is determined for a given wing area and a given weight at a certain speed. Then the section having the lowest profile drag should be the best section. Adding to the profile drag the calculated induced drag, we have the total drag. The required effective horsepower may then be calculated easily.

The normal maximum lift can be increased by increasing the angle of attack within a certain time, depending upon the airspeed. This lift will not be steady. After a short time it will return to its normal lift. Tests made by Farne showed that an increase of 35 per cent of its normal value is possible. This characteristic is called the hysteresis loop of the lift curve (Section 18).

It seems that there are many problems yet to be solved and new aerodynamic principles to be discovered with the aid of systematic testing. The real advance, however, lies in flying a new idea and letting mathematics prove it afterwards.

END

Flying Costs

FLYING courses at a typical commercial school cost from $235 to $4,685. The Boeing School of Aeronautics at Oakland, Cal., lists the following charges: airline pilot and engineering course: $4,685. Airline pilot: $3,130; special airline pilot: $1,865; limited commercial: $700; private: $635; solo: $235.

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I Learned About . . .

(*Continued from page 31*)

and not off the ground yet and not going as fast as we should be for the length of run we had made. Nothing to do but try to pull her off. Up we went and sank right back down. Thank goodness there was no obstruction at this end of the field, only a small fence. Up we went again and this time we stayed in the air. Not much climb but in the air.

It took over 15 minutes to get altitude enough to clear the 3,000-foot mountain. That also was something to think about. Only climbing 200 feet a minute with all three motors wide open—480 pounds should not make that much difference. The air was smooth as silk and after 20 minutes there was the mine below. My 50 per cent extra gas wasn't any too much. I even wondered if it was going to be enough. All the gauges read empty. This was the last time I ever made one of those short trips without at least 100 per cent reserve gas.

The field was only 1,800 feet long with a five per cent down grade and I could not throttle back the motors all the way as we were settling too fast. I would have to land with motors about half on which meant anything but a slow landing speed! How much I could not guess, but far too much to get stopped in that little down hill field.

There was no way out of it. I had to land. And there were high walls on all sides except the way I came in. I opened all motors wide just before landing to ease the shock. We hit hard anyhow and were moving fast. I cut the switches on the left outboard and center motors, knowing I am going to ground loop. Not a chance in the world to get stopped. Pine stumps and large rocks at the end. I waited until the last second, grabbed the brake lever with my left hand, shoved the right throttle wide open. Then both hands on the brake, full left rudder. Around we started. The right tire blew out. Up came the left wing. I cut the switch on the right motor. This was going to be a nasty crack-up. Would she burn? No, not enough gas for that. We seemed to hang there for hours. The right wing tip hit the ground, but the wide landing gear (18 feet) saved the day. She came on down and there we sat after making a 270° ground loop.

On the way back to the capital after repairing the tire and making sure that the wing was only damaged at the tip, I was in a daze. How could 480 pounds make so much difference under the ideal conditions and light gas load? I had carried 4,000 pounds lots of times with more gas and sometimes a co-pilot. The over-looking-something feeling still persisted. I landed and ordered my crew to start loading again, but to be sure and not have one pound over the usual 4,000. My American mechanic was missing as usual. My thoughts were worried and harassed. A native voice forced itself into my consciousness.

"The extra planks and iron, shall we leave them in, señor?"

I jumped with a dawning of what might be the truth. "What extra planks and iron?" I shouted. We always had planks on the floor when loading heavy pieces, but never more than 100 pounds. That was just standard equipment. They had been told to reinforce the floor which they had done in their usual slow way. Pieces of channel iron laid crosswise on top of the regular planking then heavy planking on top of that! Two layers!

I asked them to weigh it including the extra blocks, tackle and rope. The scales reached 500 pounds and I started for the nearest bar. That incident drove a lesson home to me:

Watch your loads and all weight. A few overlooked pounds may spell disaster.

END

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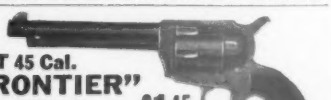

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Army Adds Schools

NINE branches of civilian schools which have been conducting elementary pilot training for the U. S. Army Air Corps have been opened in the South, Midwest and Pacific Coast, doubling civilian facilities for the national defense pilot training speed-up. The new schools are at Jackson, Miss.; Albany, Ga.; Ricks Field, Fort Worth, Texas; Oxnard, Calif.; Ontario, Calif.; Sikeston, Mo.; Hemet, Calif.; Hatbox Field, Muskogee, Okla. Graduates of the 18 schools now in operation will be given basic, advanced and specialized training at the Air Corps' three training centers. The Army plans to open 11 fields for advanced and specialized training late this year and during the early part of 1941. One of the schools, which will handle 55 students every two weeks, will be that in pursuit tow target gunnery at Eglin Field, Fla.

Billy Mitchell

(*Continued from page 62*)

seizure of Mexico. The United States needed a friendly demonstration from a great power and Russia was asked if she were willing to send a fleet to New York and another to San Francisco on a visit of friendship and good will. She replied that she would be delighted to do so, but the trip would have to be paid for by the United States, as they themselves were short of money. Upon our inquiry, Russia stated they needed about $6,200,000 to defray the expenses of the friendly visit. Naturally, Congress could not be asked for this amount, as then it would be plainly shown that the friendly visit was purchased by American money and its effect on other nations would have been diminished accordingly. So nothing was said about this sum of money until after the Civil War, when an appropriation of $7,400,000 was granted by Congress—$1,200,000 for Alaska, and $6,200,000 for the visit of the fleets!

We may well marvel over this small price. The value of the total products of Alaska, from the time it was annexed in 1867 to date, amount to over a billion dollars. During a single year now her minerals, furs, fish and other products amount to more than $70,000,000 or almost 10 times the purchase price alone.

Not only is the economic value of Alaska tremendous, but her strategic value is even greater, as already explained. In a contest between this continent and Asia it would be decisive. Alaska is the *tete du pont* or bridge head, for European culture as exemplified in America, as opposed to Asiatic culture.

In summation, we can make the statement, without fear of being gainsaid, that airpower is the deciding factor in our defense of the Pacific. Without it, any attempt to hold our possessions or protect our own country against an enemy will be fruitless.

END

Airport Improved

SURVEYED before the war as a possible American base by German, French and British airlines, the Charleston, S. C., seaplane base has been improved at a cost of $279,000 by the W.P.A. An administration building has been made out of an abandoned rice mill, a seawall built and a marine way constructed. Lake Murray, 110 miles inland, could be used as an alternate landing area in event of coastal storms. The base is listed as an alternate port by the Post Office Department and Pan American's *Atlantic Clipper* landed there last winter when storms closed its bases at New York and Baltimore. Eastern Air Lines and Delta Air Lines operate out of the land airport adjoining the base.

Aerial Hitch-hikers

JOE McClelland and J. S. Smith, University of Southern California students, thumbed a ride on a transport plane being delivered in the east and took in the New York World's Fair. Then they took a bus to Nashville and flew a Stinson "105" back to a Los Angeles distributor.

The Real Nazi Terror

(*Continued from page* 18)

started south, it never again was able to reorganize itself.

A pathetic attempt at a final stand was made in Bordeaux, but here again the same strategy was used. Bordeaux had been declared an open city, but I saw British warships in the river across from the Hotel Splendide, right in the center of the city, and the new headquarters of the Air Ministry were only two blocks away. On the nights of June 17 and 19, the Germans bombed objectives in and around Bordeaux. Shortly afterward, the French capitulated.

It has been argued that these demonstrations of German horizontal bombing accuracy indicate that they have managed to obtain samples of America's secret bomb sight or that they have succeeded in developing one equally as efficient. This is not necessarily the case, for while the German objectives were concentrated areas, they were still fairly large targets and you do not need a very remarkable bomb sight to get hits on a stationary target the size of a football stadium. Several countries are known to have electrical horizontal bomb sights which are accurate enough to duplicate these results. The real lesson is that high altitude horizontal bombing attacks can succeed even in the daytime in spite of stiff opposition and that when a legitimate military objective is destroyed the results are even more demoralizing than when metropolitan areas are bombed indiscriminately.

END

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HAROLD F. Pitcairn, president of the Pitcairn Autogiro Corporation, recently demonstrated a roadable autogiro, which was developed from a 1936 design. The engine has been installed in the fuselage aft of the cockpit. Removal of the engine from the autogiro's nose has resulted in greater visibility for the pilot. Two seats in the cabin are side by side. Three-bladed rotor can be folded back, enabling autogiro to use roads, then spread rotors for take-off.

Airman-Journalist

(*Continued from page* 30)

Warren, now a captain on the New York-Miami run, agree.

"Lawrence was my pilot in 'High Frontier'," says Jamieson. "He could fly rings around Warren and myself. He was one great guy and the nearest to perfection any flier will ever come." You will probably find Lawrence in many of Leland's stories.

Possessor of only one hobby—photography, which he plies at home in a darkroom where he can mix around in developer and hypo to his heart's content—Jamieson does all his fiction writing at his downtown business office. A careful writer, making sure he is right in every phase before he sets it down in type, he has no other formula for writing his stuff other than "trying to tell a story." If he's writing a naval aircraft carrier story like "Attack," which appeared in the *Post* in June, he writes dozens of letters to experts to gather technical information for an accurate background for his story and for a check against his finished manuscript. He has sold about 10 short stories to the *Post* plus two serials, "Attack" and "High Frontier," both of which have been optioned by Hollywood for motion picture production and scheduled for book form. Right now he's down there in his office banging away at war and airline and aviation short stories with the *Post* urging a new war serial for this winter. Yes, he sleeps and eats regularly. His wife insists upon that.

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Connecticut Adventure
by Maj. Hugh C. Downey

IT was June, 1915. The day was warm and bright. It was yet early in the day. The birds sang and the world looked rosy. At least it looked rosy to one boy. He was 21 years old. His hair was blonde and he was not bad to look upon.

He got off the train at Mineola and walked straight and fast. He knew where he wanted to go. There was a magnet attracting him. And where did he go? He walked east past the Gold Bug Inn over the Old County Road toward the Aeronautical Society hangars at Hempstead Plains, the famous old aviation field.

The boy didn't have much money. In fact he was about broke but that didn't worry him much. There was only one worry. He wanted a job, and he wanted a certain kind of job. He wanted to work on airplanes. He had faith in the future of aircraft. He expected great things.

After some 20 minutes he arrived at the entrance, such as it was, and turned in. Before him stretched the old wooden sheds with one concrete hangar in the distance. They were small compared to what we know as hangars now, but to him they were wonderful. He had been there before, had this boy. He knew his way about, but nevertheless now that he was there he was somewhat nervous.

He walked south stopping a moment to look at a Bellanca sitting outside its ramshackle shed. There didn't appear to be any great activity here, however. He walked on. Here was a chance. The Gallaudet hangar. He had heard of them before, the Gallaudets. They were reputed to have wealth more than the average of those days and already had no little fame. The hangar doors were open and inside he beheld two trim looking biplanes with doped linen wings and mahogany fuselages. One had a 50 h.p. Gnome and the other a 100 h.p. Gnome engine.

The boy devoured every detail of those two airplanes but dared not touch them, for over the two craft towered a stocky, burly fellow with grizzled curly blond hair, of powerful physique. He was blond of complexion and was very lame in one leg.

"How do you do, sir," said the boy somewhat uncertainly.

"Hello there," answered the big fellow gruffly.

"Do you need any mechanics?" asked the boy.

"What can you do?" asked the gruff one.

"I've worked on several airplanes," said the boy. Now I submit that this was a slight exaggeration but it was in a good cause.

"What airplanes have you worked on?"

"Oh," said the boy, "Cliff Hadley's *Red Devil*, Frank Burnside's Thomas boat, and several others."

"Well, well, what do you know about that?"

The definite tone of sarcasm in Dennison Gallaudet's voice caused the boy's legs to quake. He quite obviously didn't believe the boy *in toto*.

"Are you a woodworker or a metalworker or just what are you?"

Now, that was a poser.

If he had said metalworker that included a lot of mysterious things such as brazing and welding, about which the boy didn't know too much, and very few did in those days. So he said, "I was a woodworker."

Now that was not entirely untrue. He had done some considerable woodwork on boats, and Frank LaVista and he had built a plane of their own but had never had an engine that was calculated to fly it. He also had worked on one or two other planes of yore.

"So you think you want a job?"

"Yes indeed, sir," said he.

"All right, I'll give you one, what do you think of that?"

At those words his breath came in gasps and his eyes must have looked like saucers. The boy was astounded that it had been so easy. That is, thus far.

"When do we start?" he asked and he could hardly frame the words.

"I'll let you know. Give me your address."

"Thank you very, very much, sir," said he after writing out the proper address of his home.

He was in ecstasy. He was on top of the world. He was positively delighted.

The boy took another look at the two airplanes, taking in at a glance details of construction here and there. Although he wanted to linger if necessary all day to learn more about them he decided that perhaps it was wiser to leave at once since the blonde-haired ogre might, by quizzing him, learn that he didn't know as much as would be necessary in a future employe.

So the boy went about his business, but before leaving he spent hours gazing at the Bellancas, the Schmidt monoplane, Capt. Baldwin's *Red Devils* and other strange craft about the field.

Then just before the sun went down the boy returned to Mineola and got the last puffing little train out for New York City en route to his home at Dobbs Ferry, N. Y.

* * *

A week went by, then another week until a month had rolled away, whereupon I wrote to my erstwhile friend.

And lo, he wrote back across the bottom of my carefully written missive, "Come on up."

So up I went via the Fall River Line to New London and then to Norwich. My good father gave me the money somewhat disapprovingly.

In those days Norwich was one of the perhaps more prosperous little Connecticut towns on the pretty Thames River. I always loved rivers.

I want you to believe that all this was high adventure to me, and it happened 23 years ago.

Without losing any time I reported to the Gallaudet factory.

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And the Gallaudet factory was a small red wooden shed on the Thames River a mile or so south of town. There was something about it though that had aeroplane written all over it. Adjoining was a small wooden office and drafting room.

At last I could say that I was employed by an honest-to-God airplane factory.

But there were some surprises in store for me. I entered the place dressed in my best, carrying my tools and there was my cheerful friend Dennison.

"Oh hello," said he. He didn't appear at all surprised. "Get your clothes off and jump in." I did so and donned a pair of overalls.

"You're just in time," said Dennison. "We are cleaning up."

All over the place was debris, aeronautical and otherwise. They had a few woodworking machines, a hand saw, rip saw, joiner and shaper. They also had a lathe, a brazing outfit and one or two other pieces of equipment.

But the woodworking machinery was up to its neck in saw dust and the whole place was submerged by one thing or another.

We dug the woodworking machinery out, that is Felix and I did. Felix was a Thames River country boy, but a good boy at that. He was somewhat shorter than I and had a somewhat Dutch physiognomy. And there was Williams, the calm, competent machinist; and Tuttle, the draftsman; and the mysterious old person who mostly did cabinet work; and last but not least, that fine gentleman, Edson Gallaudet, the chief engineer.

We moved junk and impedimenta of all sorts until my back and muscles were sore—and I was a pretty tough bird. We worked until six that night. In fact we worked every day from seven till six and I don't mean maybe.

The following day things weren't going any better, it seemed, for Dennison found more and more tremendous plunder that had to be dislodged and moved.

After we had moved (Felix and I and Dennison) great gobs of this and that we began to uncover the loot and see what was behind all this disguise. It was really interesting.

Here we uncovered an all-aluminum tandem monoplane of beautiful construction. Even the wings were covered with aluminum. It had no engine. We hoisted it to the roof and hung it to the girders. It weighed plenty.

Next we discovered we had a fine looking Nieuport type monoplane with the propeller in the tail end. It had no engine at the moment. I had seen this before. In fact Edson almost killed himself in it a couple of years before.

And finally we found an astonishingly modern looking monoplane flying boat, with a beautiful mahogany hull and two propellers driven through shafts and bevel gears! It had a Maximotor for an engine. That's what was wrong with it. J. A. D. MacCurdy flew it but the Maxie couldn't boost it quite enough to get any performance. If I had that monoplane today maybe I could do something with it.

There before our eyes was a fortune in aircraft but aircraft that gave no return on the investment. Things were really picking up, though, or rather we were picking them up.

By the way, all this time I assumed I was earning money, but nobody mentioned dollars and cents. But I didn't care much. It was all good stuff to me and nobody seemed to worry.

"Now then," said Dennison the next day (and I thought he softened up just a little), "get busy and get this lumber in."

"And when you get through with that, go out there and change Mrs. Gallaudet's tire for her." So I struggled with the mysteries of demountable rims for an hour or so.

Next we discovered that the indefatigable trucks had left one of the tractor biplanes right under our noses. Tex Millman had just cracked her up at Mineola.

But this was different. We were tickled to lay hands on it. We got her out of the cases without even scratching it—what there was of it. Now there ensued a moment, when there wasn't so much in the air. So I proceeded to get acquainted.

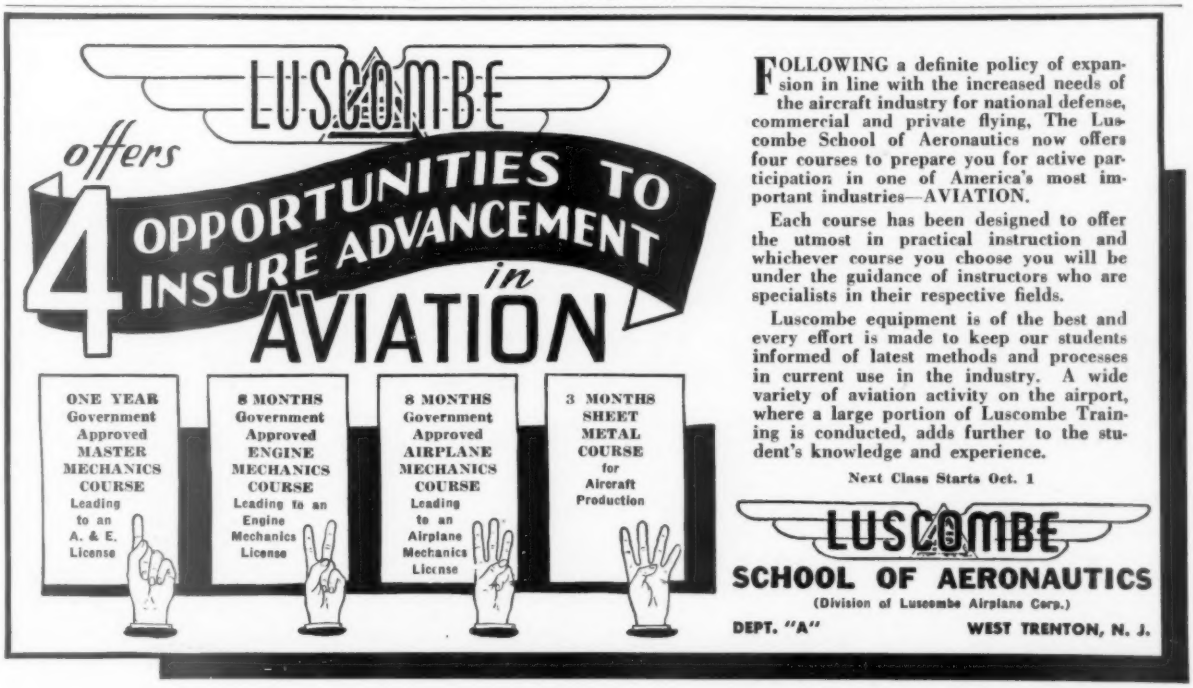
The somewhat seedy old gentleman had thus far been keeping very much to himself. I now discovered that he was making a rib jig in order to turn out new ribs for the damaged wings of the tractor ship. He handled his tools well. Anybody could see that.

I sidled up to him and made myself known. Well, we laid to and repaired the fuselage. We had many fittings to straighten or replace. We had to recover it in spots with mahogany plywood. There were new control cables to be made up. There was much to do but we loved it.

We repaired the landing gear and the engine mount and the engine itself and the wings too. Right now I want to tell you, that Dennison's eagle eye was everywhere. Woe to the fellow that didn't neutralize a cable after soldering or who drilled a ragged hole. His name was worse than mud.

Two weeks went by and I began to long for a dollar or two. In fact my landlady hinted that after all she needed dough. But I hated to mention it. Just as I was about to, Dennison announced that the Wall Street people were holding out just a little but all would be lovely in a day or two.

A day or two or three and Dennison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produced some money. He gave me $30 for two weeks' work.

For seven bucks a week I got a fine room near by, just up the hill a ways from the shop. An old Swedish woman with a bevy of blonde daughters had a room or two to let. She put out fine meals and more than we could usually eat, even with our appetites whetted by Dennison Gallaudet's gargantuan tasks. And, believe it or not, the old lady's name was Lindbergh! What was the significance of that, I wonder?

But to get back to the finance. Now $15 a week wasn't such bad pay for a youngster in those days. However, there was a string to it that caused me to do some considerable mathematical pondering.

Hardly a day went by that I didn't discover that I needed some rather expensive additional tool since we were doing work that at times was extremely precise, when done by hand. This required good, accurate, sharp tools. And, mister, we supplied our own. I had bought, a day or two before, with my last five dollars, a set of chisels and a steel scale. My father sent me a nice set of drills.

The townspeople thought we were crazy. When we spoke, somewhat timidly perhaps, about airplanes of the future they looked at us with a loose jawed sidelong glance that plainly indicated doubt as to our sanity. That is all, perhaps, except maybe one blonde haired girl. The idea of airplanes that would make 200 miles an hour and carry 20 passengers was to them just an idiotic fantasy. But just out of sure bravado in order, perhaps, to keep up our own morale in the face of the jeers of the mob we stuck to our guns and insisted that 150 m.p.h. was possible even if we couldn't carry very much, but even so we weren't quite sure; we had to admit it to ourselves. And engines, well, we thought maybe some day we would have 300 h.p.

After a month or so we at last got the tractor together again and got the engine going. What a sweet purr those Gnomes did have, but what an infernal amount of attention they did require. And then we took her down to Mineola and Tex Millman tried her out.

"As good as new," he said and we felt proud. We were high. That night we went over to Four Corners for a bit of justifiable celebrating. There was never any greater kick than that, to do a good job on an airplane and find that she flies as well or better than ever.

And that reminds me of something. Nowadays a rigger is hardly needed on these tin cantilever jobs. But then, my friends, a rigger was a guy to be appreciated.

He was an artist. He it was who adjusted incidence and stagger and sweepback. He it was who put just a little more glorious performance in the machine by taking up here or slacking off there on the right cable.

I insist that was one of the joys of working on planes then. A well rigged ship was a rigger's symphony. Those who never did it maybe missed something.

I remember the time that Jim Valentine cut the wing beams one-quarter of an inch too short and the time I spoiled one of the manganese bronze fittings and how Dennison swore a blue streak.

We used to braze steel fittings with two gasoline torches that put out a roaring inferno of heat, and we would work stripped to the waist, with sweat pouring down our faces, with Dennison stomping around on his game leg, presiding over the whole business, like Vulcan over the mythical forge.

Ah well, that's enough of that. We are still at Mineola.

"Where do we go from here?" said we.

"Back to Norwich," said Dennison. "We have a Navy contract."

That was news, gentlemen, and I mean news. The great U. S. Government was about to step in. It looked like real money to us because previously there was no guarantee that we would work the next day. So back we went and sailed into the job of laying out for the new Navy seaplane.

It was a two-motored, single-float job with engines in tandem in the fuselage, having one propeller.

Now that was something of a conception. It was Edson's conception and Edson was a brilliant man. It had a span of about 50 feet. I don't remember exactly. I should have taken pictures in those days, but I didn't own a camera. It had a terrific sweepback and a long pointed nose.

Edson, you see, was endeavoring to get the maximum possible propeller efficiency. That is why he put the engines in tandem driving one propeller through clutches and gears. The tail was connected behind the propeller through an ingenious system of ball bearings. One strut ran from the tail end of the central float out to the end of the fuselage, thus stiffening up the empennage. It was also guyed with cables. The idea was, of course, that there should not be any great amount of obstruction either in front of or behind the propeller.

But, brother, there was plenty of labor required to do all this. I sawed hard metal by hand day after day. I drilled myriads of holes and filed yards and yards of high carbon steel to a thin straight line that was scribed on the coppered plate, for hours and hours.

I planned wing beams to $\frac{1}{64}$ of an inch tolerance until they were straight to the eye for 25 feet. But it was good for the soul. It does something for a guy. We were producing a mechanical bird that would perform only as well as we wrought and we meant to make her perform.

We spliced and wrapped cables with infinite care. We built the floats and copper riveted them religiously. There were 20,000 rivets in those floats and every rivet was sound.

But we had our idle moments when we ate our lunch, or late at night under the moonlight after work was over. Then we would resume those interminable but always interesting discussions of just what the airplane of the future would look like and what could be done to improve the present ship.

There were those who proposed more stagger, and those who proposed more wing area and each had his own pet theories. But one and all could see that more power and less head resistance were necessary. Invariably we wound up with a problem or a question which we would take to Edson, for Edson was the final authority to us, then and there. . . .

Have you ever wrapped and spliced cables? Have you wrapped and spliced and soldered hundreds of cables? Well, if you have you know it is work. We pondered over the problem of reducing the labor required and we finally solved it. It was simple enough. You took an old breast drill and mounted it on a table horizontally in such a way that you could turn it. You then got yourself a ball bearing with about one and a half inch of bore in it, whereupon you made two grooved wedges to hold one end of the cable in the bore. Then, of course, you put your looped end over a hook in the chuck of the drill. The rest was easy. You already had the end of your loop soldered against the shank of the cable. You simply started your wire on and fed it while someone turned the drill. We saved a lot of time on that.

Have you ever assembled wooden wings and fitted a thousand small blocks to ribs to buttress them? Have you ever trussed them with cables or tie rods and trammed them back and forth a dozen times to be sure of alignment? That's work, too, but it was healthy work. We checked and rechecked dimensions until there was nothing $\frac{1}{32}$ of an inch out.

I went over to the bandsaw to cut out a block of irregular shape. It jumped off the wheels and wrapped itself around my neck, but I didn't get a scratch. The belt on the rip saw would regularly break once a day and nearly scare you silly. The brazing outfit would burn you often but you didn't mind that. Finally one day poor Tuttle cut four fingers off his right hand, smack before my eyes. He took it like a man but it broke his heart.

But I say to you again, that it was good for one, because we were pioneering. I have never enjoyed anything more, even if Dennison Gallaudet did swear with gusto at times.

We made gas tanks and gas lines and electrical connections and countless other parts all by hand.

The engines, two Dusenbergs, arrived one day and we installed them. Captain (later Admiral) Mark L. Bristol came up to inspect our job and found it good.

And those manganese bronze fittings. I must tell about those.

Have you ever filed manganese bronze? I did. All the fittings exposed to the atmosphere or water were made of manganese bronze. These came in the form of castings and were plenty heavy and hard as hell. So we cut them all down and filed all surplus metal off for lightness, and that was plenty tough going.

So we finally wound up the seaplane for the Navy and she was quite a success for her day. She made nearly 150 m.p.h. There were many things that were not

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quite what we would expect today. The tail was somewhat shaky because you see it was hitched on behind the propeller and she was very heavy, what with all those manganese bronze fittings, and those engines, but on the whole she did pretty well.

If any of my old companions read this I want to say that I don't forget. I couldn't forget all that.

I couldn't forget the gentleman who sang of four kegs of beer or the ride on the Thames River in his motorboat or the blonde-haired girls at the boarding house.

I couldn't forget Felix and Williams and Tuttle and Jim Valentine, or anybody who was there. They weren't looking for publicity, either.

Yes, and I must thank Edson Gallaudet, the kindly one and Dennison Gallaudet, the crusty one, for a very fine experience.

Much water has gone over the dam, and this I realize is ancient history, but our memories help console us. I have had thousands of hours in the air since then in far places but some day I'll go back and go over those scenes again. They are indelible.

END

Are You Qualified?

(*Continued from page* 34)

schools misserving not only the aircraft industry, but almost every other business. The large majority of aviation trade schools are absolutely reliable in their claims, charge tuition fees that are not unreasonable—considering the tools, materials and specialized instruction they make available to their students—and make an honest effort to place their graduates. Buying training, though, is like buying anything else. You can get good merchandise or bad and the selection of the school deserves at least the same thought and care you would give to the purchase of a suit of clothes or a pair of shoes. Most of the aviation magazines carry trade school advertising and many of them make it their policy to check up on the reliability and truthfulness of the statements made. Almost any reliable school will be glad to put prospective enrollers in touch with its graduates so that they may discover for themselves whether these graduates are satisfied with their bargains.

Several things have to be remembered. No trade school—however good its training may be—can *guarantee* employment to anyone. There are qualities of personality and of natural aptitude in some men which no amount of training can overcome; just as some men can never learn to drive a car or a golf ball successfully. Likewise, there is always the law of supply and demand. If there aren't jobs to be had, no amount of training will get you one. In the main, though, that course in drafting or aircraft sheet metal or metallurgy or engine mechanics or what ever else it may be, is about the shortest path to a meal ticket you can take. Training—real education or experience—is the secret of success in any line of endeavor. Never forget that when you walk up to that employment manager and he starts interviewing you for a job, he's going to be interested in just one thing:

"Are you qualified?"

END

Pilots Needed!

(*Continued from page* 22)

periods. Not all military instructions can be conducted without complete military equipment. Particularly can formation flying and simple military maneuvers be included. Military aerial tactics can be taught. Gunnery work, bombing practice, and other basic subjects can be covered.

Another plan is for the Government to establish flying instruction centers at every airport in the county where potential pilot-power is available. For such training centers a single instructor and one mechanic could maintain and operate a squadron of lightplanes. One instructor can handle 15 students at a time with ease, probably twice that many under pressure. He could solo one new pilot every day. Add to that two months training within the squadron in all feasible military training adaptable to the putt-putt planes and one new pilot per squadron per day can be handed to the Army or Navy ready to do mass pilot work with another month's or less, training on the bigger and faster combat planes. There are 790 municipal airports at cities from 10,000 population up. With 500 of these squadrons 15,000 pilots could be trained each month. Not only is the cost of equipment and operation in such training squadrons slashed to the minimum, but all the personal expenses of the student—his clothing, room, board—are eliminated since the student trains from his own doorstep.

America's aerial defense is worth just as much as our pilots. We need tens of thousands of *expert* pilots for standing defense; hundreds of thousands of *mass* pilots to follow them in wartime defense.

END

X-Raying Parts

AN automatic x-ray machine which is able to photograph 5,000 airplane parts a day has been completed in the Triplett & Barton laboratories in the Lockheed plant at Burbank, Cal. Pictures show casting flaws.

The Water's Fine!

(*Continued from page 41*)

ties for seaplane terminals. The Seaplane Flying Association is co-operating in the selection of sites.

The facilities included in the program are floats, single or in combination of a number of units to make larger bases; moorings, wind-cones and, in such instances as needed dollies for use on existing ramps. Comprehensive plans for simple landing floats suitable for all ordinary purposes have been prepared by the airport section, Technical Development Division of the C.A.A. They are available for distribution to anyone desiring to build a seaplane float whether no not N.Y.A. labor is to be used. Working drawings of several types of bases and of the so-called "Boston dolly" and estimates of the cost of materials for each can be had for the asking.

Cost of the float adopted as a standard, which measures 10 by 22 feet and is constructed of lumber supported by steel drums, is well under $100 for materials and the dolly can be built for about $80. The floats, docks and dollies may either be prefrabricated in shops and delivered to site for placement or pre-cut and assembled at the site.

END

New Direction Finder

AN automatic direction finder has been developed by Lear Avia, Inc., which simplifies operation of the instrument. The pilot need only switch to the desired function and tune to the required frequency. Model ADF-8 does the rest. It gathers the information and gives the answer. Manual aural and visual direction finding are also possible with the instrument. The azimuth indicator, pictured above, gives bearings over a 360° scale. Static conditions which would interfere with voice or range reception do not affect the finder. Apparatus includes an automatic station-seeking loop in a streamlined nacelle, quadrantal error correcting mechanism, 19-tube superheterodyne receiver, a 12 or 24-volt dynamotor, remote control panel and indicator. Total weight of the apparatus installed is 60 pounds. There are four-band and six-band models.

Lightplane Radio

(*Continued from page 28*)

to operate a radio receiver, let alone the combination receiver-transmitter without a generator installation. With dry cells we have licked cost, weight and have eliminated accessories.

For simple receiver installations the overhead type antenna has been found best. However, the belly antenna is more accurate in locating cones of silence. But as the lightplane owner usually is not interested in extremely accurate instrument flying the advantage of the latter is hardly worth considering. The wind cone type antenna extended from the fin for reception also is not as accurate as the belly antenna for locating cones of silence. The disadvantage is again negligible. An advantage of the wind cone type is that when fully unreeled it increases reception above either the fixed overhead or fixed belly antenna.

Problems are being licked daily and good radio is available at reasonable prices for your lightplane. Your radio, whether it's "R-only" or both transmitter and receiver, is cheaper to buy, lighter, more compact and more efficient than it was yesterday. And whether you feel that you can get along without it or whether you have to have one right away it's definitely here to stay.

END

This Month's Model

(*Continued from page 56*)

attempt to carve it out of two solid blocks as an unsatisfactory job will result. Cone-shaped dotted lines, shown in the side view, are to hold the two halves in perfect alignment. If you do not wish to make the core box, it will not be necessary to have the cores on the master pattern. We recommend a core box, as it will eliminate a lot of unnecessary machining of aluminum casting. If you are unable to make these patterns and must have castings made, write the author in care of this magazine. In the next article, we will deal with the machining of the various parts.

END

400 m.p.h. Tunnel

CONSTRUCTION has begun on the world's most powerful wind tunnel for the Army Air Corps at Wright Field, Dayton, Ohio. The 20-foot tunnel will test models at speeds of approximately 400 m.p.h. A 40,000 h.p. electric motor is being built to drive the air through the 790-foot metalclad chamber. The motor, which will weigh 125 tons, is the largest rotor induction type machine ever designed, Westinghouse Electric & Manufacturing Company engineers said. The tunnel will permit use of models with a wing spread of 15 feet.

School Expands

AVIATION Institute, mechanics training school branch of Frank Ambrose, Inc., has leased 52,000 square feet of floor space and 30,000 square feet of enclosed yard for expansion in Long Island City, N. Y.

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Airy Chat

(*Continued from page 4*)

invasions will come, because they are the shortest lines and aircraft will fly directly along them . . ." Remember the recent hullabaloo when someone announced that the Russians have established an air base just a few miles from American soil?

Think of the German conquests today when you read this next 11-year-old warning: "*If the United States had a well-organized air force, entirely independent of the Army and Navy, it would be completely immune from overseas attack. No ship can approach our coast across the Atlantic or Pacific oceans in the face of a well-organized air force. The air force is the only thing that can go up in the air and fight hostile aircraft.*"

Well, we don't have that air force today and we're a long way from it. But the danger, as we all know, is much closer. Those men charged with this country's defense have had plenty of time to do something about it—11 years, at least. Are these venerable, unprogressive ancients going to steer us into the fate of France? What good will it do us to try these men at an American Riom?

* * *

IT was a shocker, that line in Robert A. Winston's "The Real Nazi Terror" on page 16 telling of a smoke-writing airplane leading German bombing squadrons to their objective. We don't know what military experts will make of it, but we can't help feel that Winston's statement is pretty fair proof that German pilots are becoming more and more inferior. At least we can't think of any other reason for a smoke-writing airplane participating in a high altitude raid other than to lead a bunch of highly inexperienced and untrained German flyers to their goal.

* * *

EVERYONE in aviation who knows him agree that Hans Groenhoff is well worth the publicity he gets in "Photo by Groenhoff" (page 24). He's one of those rare chaps who always stays in the background, does the finest work of its kind in the business and stares with awe at other photographers as though they were heroes. He's so shy it took the combination of E. Jay Doherty and ourselves some three weeks to get our article out of him.

* * *

MR. DOHERTY, by the by, is a chap you should know. We "discovered" him and we're proud of the fact. He calls himself "E. Jay" because his father, Edward J. Doherty, has done quite well with the latter name, writing for various leading magazines and newspapers. Our Mr. Do-

herty, though, had never banged a typewriter profitably until something inspired him to describe his job as an airline passenger agent and submit the results to us. We bought the thing pronto, to find later that we'd officially launched a budding new writer. That first article was "Man of a Thousand Headaches" in the October, 1939, issue. Anyone wanting to meet a good FLYING AND POPULAR AVIATION correspondent will find E. Jay soothing passengers at LaGuardia Field, New York City.

* * *

WHAT'S-IN-THE-WIND . . . Charles Belden, the flying rancher who wrote "Aerial Angling" in our last issue, flew eight young antelope from his Pitchfork, Wyo., ranch to a Lake Placid, N. Y., buyer in 12 hours flat . . . the trip was made in the Lockheed "12" of Justin (Walgreen Drug Co.) Dart. . . . Maj. Alexander P. de Seversky, former head of the now-Republic Aviation Corporation, has filed suit against certain Republic officials. . . . Dr. Ross A. MacFarland, prominent in aviation medicine, floored the aviation industry with this one recently: the average number of children born to the wives of airline pilots is 0.8 per pilot. . . . The Army's new Consolidated XB-24 now carries one of those motor scooters for its pilots to use around airports. . . . All we can say about that "Wings Over America" radio program is ooooooh! . . . The U. S. Navy has just granted the Grumman company contracts totaling $7,954,900.28. . . . Among some 43 American pilots currently serving as instructors in Canada are Homer Berry, former Bell test pilot; "Knick" Knickerbocker, formerly publicity man for a Hollywood hotel; and Joe James, free lance flyer who used to write for FLYING AND POPULAR AVIATION. . . . A private flyer in New Jersey recently landed his seaplane on a lake in that state and was arrested for not having a marine captain's certificate and a license to operate a surface vessel! . . . Remember "My Thoughts on the War" by Major Seversky in our April issue? . . . well, it was swiped first by the Italian *L'Ala d'Italia* then by the British *Flight*. . . . One British fighter squadron leader recently received a medal after his outfit shot down 38 German planes on two patrols! . . . They swear this story about the Harlow prototype is true . . . the test pilot had it up and was spinning it . . . it refused to come out of a spin so the pilot bailed out . . . minus the pilot's weight, the ship's nose came up nicely, it went into a steep glide, landed directly on both wheels in a field, bounced, ground-looped, broke a wing tip and propeller, then stopped! . . .

* * *

IN a way, we're sorry Al Williams' new book, Airpower, is written the way it is. Although it's full of many worthy facts and recommendations, Al's method of writing definitely detracts from Airpower's value. Being a fiery fellow anyway, Al tossed caution overboard and called every spade a blankety-blank shovel. Seems to us Airpower would have gone much farther had Al not been so vitriolic and let the many excellent points he makes stand on their own feet. Anyway, Al Williams has something all of us need more of: courage.

* * *

Which is an asset, these days. M. K.

END

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Bailey Flyg. Service, Kirksville, Mo.	Chief	Lyc. 65	250 hr.		1450
Mountain States Aviation, Denver, Colo.	Chief	Cont. 65	750 hr.	5 hr.	1400
Eno Flyg. Serv., Fort Dodge, Ia.	50-C	Cont. 50	300 hr.		1400
Cincinnati Aircraft Serv., Cincinnati, O.		Lyc.	455 hr.		1350
Baker-Eberle Aviation, Detroit, Mich.	Chief	Cont. 65	725 hr.	now	1325
G&R Air Serv., Alexandria, Va.	65-C	Cont. 65	289 hr.	yes	1300
Portland Flyg. Serv., Portland, Me.	Chief	Lyc. 55	410 hr.	360 hr.	1295
A.R.Smith,113 E.Commerce,Aberdeen,Md.	Chief	Cont. A-50	245 hr.	May '40	1295
J. K. Hinson, Rutherford Fld., Woodlawn, Md.	Chief	Cont. 65	73 hr.	no	1295
Warsaw Air Service, Warsaw, Ind.	1939	Lyc. 50	560 hr.	400 hr.	1295
Frontier Flyg. Serv., Int'l Falls, Minn.		LeBlond 90	258 hr.	17 hr.	1275
Consol. School Aviation, E. St. Louis, Ill.		Cont. 50	270 hr.		1275
Blvd. Arpt., Inc., Red Lion Rd., Phila., Pa.	Tandem	Frank. 60	100 hr.		1250
Leeward Aircraft, New Kensington, Pa.	Chief	Cont. 50	135 hr.	5 hr.	1245
Lenhart Flyg. Serv., Mun. Arpt., Marion, Ind.	65-LA	Lyc. 65	290 hr.	290 hr.	1195
Lenhart Flyg. Serv., Mnn. Arpt., Marion, Ind.	TF	Frank. 60	55 hr.		1195
Blvd. Arpt., Inc., Red Lion Rd., Phila., Pa.	Chiefs (3)	Lyc. 50-55	300 hr.		1175 each
Baker-Eberle Aviation, Detroit, Mich.	Chief	Cont. 85	915 hr.	115 hr.	1150
J. F. Whickir, Mun. Arpt., Ft. Wayne, Ind.		Cont. 65	587 hr.	15 hr.	1150
Jesse Jones, Lancaster, Pa.	Low-wing	LeBlond 85	300 hr.	July '40	1025
SE Kansas Aircraft Serv., Chanute, Kan.		Frank. 50	746 hr.	327 hr.	1100
Allied Aircraft Sales, Davenport, Ia.		Lyc. 55	746 hr.	327 hr.	1100
J. A. Atherton Co., 2478 Univ., St. Paul, Minn.		Lyc. 50	350 hr.		1075
Aero Ways Inc., Cleveland, Ohio.		Cont. 50	127 hr.		1050
Queen City Flyg. Serv., Cincinnati, Ohio.		Cont. 50	663 hr.		1050
H. G. Mayes, Huntington, W. Va.		Cont. 50	788 hr.	38 hr.	1050
United Aero Corp., San Antonio, Tex.	50	Frank. 50	700 hr.	500 hr.	1050
Cincinnati Aircraft, Cincinnati, Ohio.		Frank.	563 hr.		1025
Hass-Hillyard, Mun. Arpt., Evansville, Ind.	C-50	Cont. 50	1100 hr.	950 hr.	1000
Hass-Hillyard, Mun. Arpt., Evansville, Ind.	C-50	Cont. 50	400 hr.	350 hr.	1000
Chas. Roberts, Mun. Arpt., Dothan, Ala.		Cont. 50	375 hr.		1000
O. E. Dickerhoof, Mun. Arpt., Chanute, Kan.		Frank.	457 hr.	400 hr.	1000
Virginia Air Serv., Gordonsville, Va.	Chief	Lyc. 50	700 hr.	May '40	985
Baker-Eberle Aviation, Detroit, Mich.	K-45	Aero. 45	300 hr.	now	935
Hass-Hillyard, Mun. Arpt., Evansville, Ind.		Cont. 50	800 hr.	750 hr.	900
Portland Flyg. Serv., Portland, Me.		Menas. 50	425 hr.	none	875
Huron Flyg. Serv., Huron, So. Dakota.		Frank. 40	350 hr.		850
Florida Aero & Supply, Orlando, Fla.		Aero. 40	[illegible] hr.		795
Ryan Air Service, Decorah, Ia.		Aero. 45	318 hr.		795
A. R. Smith, 113 E. Commerce, Aberdeen, Md.	K	Aero. E	850 hr.	30 hr.	775
Pierce Flyg. Serv., 2135 Bwy, Eureka, Cal.	KC	Cont. 40	600 hr.	200 hr.	765
Aircraft Unlimited, Mineola, N. Y.	K	Aero. 40	966 hr.	now	700
Buroker-Hicks Flyg. Serv., Olympia, Wash.	K	Aero. 40	400 hr.		700
Tred Avon Flyg. Serv., Easton, Md.	KC	Cont. 40	650 hr.	yes	700
St. Louis Flg. Sv., Lambert Fd., St. Louis, Mo.	K	Aeronca	745 hr.	1½ hr.	695
Huron Flyg. Serv., Huron, So. Dakota.		Aeronca	487 hr.	30 hr.	695
O. L. Hostetter, Thomasville, Pa.		Aeronca	650 hr.	none	695
Mississippi Arwys., Jackson, Miss.		Aeronca	406 hr.	Nov '39	675
Youngstown Arwys., Youngstown, Ohio.	K	Aero. 37	300 hr.		675
Lane Air Serv., Mun. Arpt., Albany, Ga.	K	Aero. 42	450 hr.	50 hr.	675
Hylan Flyg. Serv., Arpt., Rochester, N. Y.		Aero. 40	300 hr.	300 hr.	650
Jenkins Air Serv., Rochester, N. Y.		Aero. 40	400 hr.		650
Oakland Aircraft Corp., Alameda, Cal.	K	Aero. 40	730 hr.	Oct. '39	$650
Pioneer Air Serv., Romulus, Mich.	K	Aero. 40	482 hr.	9 hr.	600
East Coast Arwys., W. Hanover, Mass.	K	Aero.	525 hr.	Nov. '39	600
United Aero Corp., San Antonio, Tex.	C-3	Aero. 40	700 hr.	15 hr.	575
Hobley-Maynard Air Serv., New Orleans, La.		E113C		recently	550
Morley Airplane Co., Madison, Wisc.		Aeronca	250 hr.		550
Pierce Flyg. Serv., Eureka, Cal.		Aero. 36	1500 hr.	100 hr.	535
Aviation Serv., Inc., Newport News, Va.		E113C	500 hr.	80 hr.	525
A. R. Smith, 113 E. Commerce, Aberdeen, Md.	C-3	Aero. E	750 hr.	Oct. '39	505
Jersey Flyg. Serv., Oakland, N. J.		Aero. 37	450 hr.	50 hr.	500
W. B. Skelton, Greenville, Pa.	C-3	Aero. 113	800 hr.	Jan. '40	500
Virginia Cub Dist., Farmville, Va.	C-3	Aeronca	225 hr.	20 hr.	500
D. Rohn, 1300 Monroe, Beardstown, Ill.	C-3	Aero. 36	300 hr.	30 hr.	500
Currey Flyg. Serv., Galesburg, Ill.	C-3	Aero. 37	800 hr.	20 hr.	500
AMERICAN EAGLE					
Lenhart Flyg. Serv., Marion, Ind.		Kinner 100	1010 hr.	1010 hr.	550
Maheux's Airport, Inc., Auburn, Me.		Kinner 100			595
ARGO					
Allstate Airways, Haverhill, Mass.	Hess	Warner 115	35 hr.	35 hr.	850
Red Bank Airport, Inc., Red Bank, N. J.	A	Hess Warrior 115	420 hr.	42 hr.	1050
ARISTOCRAT					
Red Bank Airport, Inc., Red Bank, N. J.	102A	Warner 125	357 hr.	35 hr.	750
Red Bank Arpt., Inc., Red Bank, N. J.		Warner 125	350 hr.	35 hr.	750
BEECH					
Harry A. Hammill, Austin, Tex.		Wasp 450	500 hr.	none	8500
Harry A. Hammill, Austin, Tex.		Wright 450	600 hr.	250 hr.	8500
BOEING					
J. O. Dockery, Stuttgart, Ark.	Duster	Hornet 600	1296 hr.	1175 hr.	2500
COMMANDAIRE					
Alliance Flyg. Ser., Alliance, Nebr.		Curtiss OX5	350 hr.	10 hr.	550
CONSOLIDATED					
J. L. Schroeder, Inc., Houston, Texas.		J-5 225 hp	530 hr.	45 hr.	850
CURTISS ROBIN					
Toomey, Gatleff & Webb, Knoxville, Tenn.		Wright 165	575 hr.	170 hr.	1400
A. R. Goldsmith, 61 Orchard, Manchester, N.H.	J65	Wright 175	700 hr.	150 hr.	1200
Leeward Aircraft, New Kensington, Pa.		Chall. 185	512 hr.	17 hr.	885
Geo. Roper, 27 S. State, Salt Lake City, U.		Challenger	800 hr.	Mar. '40	800
Regan Flyg. Serv., Shawnee, Okla.	J65		300 hr.	50 hr.	795
Safair, Inc., Roosevelt Fld., Mineola, N. Y.		Chall. 185	1200 hr.	Jan. '40	750
H.L.Peterson,W'mson-J'ns'n Arpt., Duluth, Mn.		Curtiss Chall.	442 hr.	190 hr.	750
A. A. Goldsmith, Nashua, N. H.		Wright J65	700 hr.	150 hr.	700
North West Jersey Air Serv., Clinton, N. J.		Chall. 185	550 hr.		675
A. Gillis Flyg. Serv., Great Falls, Mont.		Chall. 185	800 hr.	10 hr.	650
Aero Service, McKinley Arpt., Canton, O.		Chall. 185	800 hr.	70 hr.	650
J. L. Schroeder, Inc., Rt. No. 3, Houston, Tex.		Chall. 185	680 hr.	60 hr.	600
United Aero Corp., San Antonio, Tex.		Chall. 185	650 hr.	350 hr.	600
R. A. Miller, North Benton, Ohio.		Chall. 185	444 hr.	380 hr.	550

An Important Aviation Announcement!

TWELVE years ago the Monocoupe Company revised all aviation thinking in terms of private aircraft by announcing the first side by side two place cabin plane. Echoes of this proven departure from the accepted type of aircraft have not ceased even today—the design, performance and economy are still the goal of all manufacturers who have tried to follow the lead so long ago advanced. . . . Today Monocoupe announces a new sales program that in time will make aviation history. A new plan of merchandising aircraft that is as abrupt a departure from the ordinary "factory representation" as the original design of the first Monocoupe. . . . A new staff of national sales executives long experienced in the financing and merchandising machinery of the automotive world, have plans ready to offer wide awake dealers, pilots or operators interested in acquiring state-wide franchises. Every enterprising aviation sales enthusiast will be interested in learning how 1940 and 1941 aircraft sales can be turned into additional income. Write department PA for full particulars.

THE Monocoupe

AEROPLANE AND ENGINE SALES CORP.

444 Madison Avenue, New York City

FACTORY: ORLANDO, FLORIDA

FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE	TIME	OVER-HAULED	PRICE
DART				
Brayton Flg. Sv.,Lambert Arpt., Robertson, Mo.	Ken-Royce	250 hr.	200 hr.	$2975
Ashcraft Bros. Flyg. Serv., Lawrence, Kans...	LeBlond	370 hr.	325 hr.	2250
Dupont Arpt., Wilmington, Del.....	Low Wing Ken-Royce 90	900 hr.	100 hr.	2200
Lane Aviation Corp., Cleveland, Ohio.....	G.K. Ken-Royce	498 hr.	108 hr.	2150
Port Columbus Flyg. Serv. Port Columbus, O.	G Lambert	941 hr.	160 hr.	1600
DOUGLAS				
J. L. Schroeder, Inc., Houston, Texas.....	400 Liberty	unknown	60 hr.	550
EAGLEROCK				
Thompson Flyg. Serv., Salt Lake City, Utah..	Wright J5	1049 hr.	149 hr.	1000
A. Whitaker, Swan Isl. Arpt., Portland, Ore..	Wright	1035 hr.	50 hr.	750
J. O. Dockery, Stuttgart, Ark.....	Hisso 180	800 hr.	70 hr.	550
EMSCO				
A. Whitaker, Swan Isl. Arpt., Portland, Ore..	Chall. 185	600 hr.		650
FAIRCHILD				
Bob Wight, Box 487, Biloxi, Miss.....	45 Wright 350	165 hr.		7500
Dupont Airport, Wilmington, Del.....	24 Warner 145	55 hr.	new	6380
D. H. Wallace, Clarcona, Fla.....	24 Warner 145	10 hr.	yes	6000
Carolina Aircraft Sales, Charlotte, N. C....	Warner 145	102 hr.	new	5750
York Airport, Thomasville, Pa.....	24 Warner 145	225 hr.	15 hr.	4900
Bob Wight, Box 487, Biloxi, Miss.....	24 Warner 145	175 hr.	yes	3995
T. A. Culbertson, Medford, Oregon.....	246 Warner 145	800 hr.	350 hr.	3500
Dupont Airport, Wilmington, Del.....	24 Warner 145	590 hr.	100 hr.	3250
Colorado Aviation, Denver, Colo.....	Warner 145	470 hr.	50 hr.	3150
Red Bank Airport, Inc., Red Bank, N. J.....	24 Ranger 150	795 hr.	375 hr.	2695
Leech Aircraft, Roosevelt Fld., Mineola, N. Y.	24 Ranger 145	1071 hr.	245 hr.	2600
California Aircraft Corp., Van Nuys, Cal....	24 Warner 145	400 hr.	none	2250
Neil McCray Arprt., Jamestown, N. Y.....	Ranger	480 hr.	350 hr.	2350
Schneider Aero Serv., Fresno, Calif.....	Warner 145	954 hr.	206 hr.	2150
West Coast Aircraft, Inglewood, Calif.....	24 Warner 145	755 hr.	227 hr.	2150
Inter-City Airlines, East Boston Mass.....	24 Ranger 145	540 hr.	40 hr.	2150
Chicago Aviation Corp., Glenview, Ill.....	24 Warner 125	490 hr.	390 hr.	1595
Red Bank Airport, Inc., Red Bank, N. J.....	24 Warner 125	443 hr.	203 hr.	1500
Walz Corp. Central Arpt., Camden, N. J....	22 Cirrus 95	973 hr.	210 hr.	1450
Harrisburg Air Serv., Harrisburg, Pa.....	Wright	800 hr.	200 hr.	1100
Virginia Cub Dist. Inc., Farmville, Va.....	KR34 Wright	500 hr.	100 hr.	1100
A. Whitaker, Swan Is. Arpt., Portland, Ore..	24 Cirrus	895 hr.	50 hr.	850
J. L. Schroeder, Inc., Rt. No. 3, Houston, Tex.	21 Kinner 100	690 hr.	60 hr.	825
FLEET				
Safair, Inc., Mineola, N. Y.....	Kinner 100	2500 hr.	Dec. '39	850
Safair, Inc., Mineola, N. Y.....	Kinner 100	3000 hr.	Sept.'39	850
FRANKLIN				
North West Jersey Air Service, Clinton, N. J.	Sport Lambert 90	600 hr.	May '40	700
FUNK				
Bailey Flyg. Serv., Corning, N. Y.....	Funk 63	84 hr.	none	1665
GREAT LAKES				
Racine Flyg. Serv., Inc., Racine, Wis.....	Cirrus	362 hr.	125 hr.	800
United Aero Corp., San Antonio, Tex.....	Cirrus 90	450 hr.	435 hr.	800
P. A. Meinke, Willoughby, Ohio.....	Cirrus	300 hr.	yes	750
HAMMOND				
A. J. Hartman, Burlington Arpt., Burlington, Ia.	Kinner 100	800 hr.	June '40	750
KELLETT GIRO				
Red Bank Arpt., Inc., Red Bank, N. J.....	Cont. 210	400 hr.		1700
KINNER				
California Aircraft, Van Nuys, Calif.....	K-5 Kinner 100	1000 hr.	none	1350
KINNER SPORTWING				
Schneider Aero. Serv., Fresno, Calif.....	B-5 125	1335 hr.	506 hr.	1350
Louisville Flyg. Serv., Inc., Louisville, Ky.....	Kinner K-5	460 hr.		945

DEALERS	MODEL AND ENGINE	TIME	OVER-HAULED	PRICE
LAIRD				
J. O. Dockery, Stuttgart, Ark.....	J-5-220	845 hr.	825 hr.	$1750
LINCOLN				
Peoria Aero Sales, 342 Knoxville, Peoria, Ill.	Kinner B-5	400 hr.	50 hr.	895
Fox Valley Flyg. Serv., Aurora, Ill.....	Kinner	1468 hr.	150 hr.	500
H. B. Chapman, N. Arpt., New Orleans, La..	Kinner 100	985 ship 750 eng.	'39	500
LOCKHEED				
Des Moines Flyg. Serv., Inc., Des Moines, Ia..	Wasp 450	1500 hr.	75 hr.	3500
LOCKHEED VEGA				
Harry A Hammill, Austin, Texas.....	Wasp S-1-D-1	.....	none	5500
LUSCOMBE				
Falcom Aircraft,L.A.Mun.Arpt.,Inglewood,Cal.	Phantom Warner 145	new		4000
C. Evers, 247 Park Ave., N. Y., N. Y.....	Seaplane Cont. 65	40 hr.	none	2800
D. Schall, 33 Claggett Rd., Hyattsville, Md..	8-B Lyc. 65	35 hr.	new	1895
Massey & Ransom Flyg. Serv., Denver, Colo.	Cont. 65	335 hr.		1875
Jersey Flyg. Serv., Oakland, N. J.....	Cont. 65	91 hr.		1850
Warsaw Air Service, Warsaw, Ind.....	8A Cont. 65	340 hr.		1800
Walz Corp. Central Arpt., Camden, N. J...	Cont. 65	200 hr.	none	1785
Ia. Airplane Co., Mun. Arpt., Des Moines, Ia.	Cont. 65	350 hr.	350 hr.	1750
Page Airways, Inc., Rochester, N. Y.....	Cont. 65	200 hr.	none	1750
Massey & Ransom Flyg. Serv., Denver, Colo.	Cont. 65	350 hr.	60 hr.	1725
Ia. Airplane Co., Mun. Arpt., Des Moines, Ia.	Cont. 65	400 hr.	400 hr.	1700
J. L. Wells, 106 W. Main, Avon Park, Fla...	8A Cont. 65	95 hr.	none	1675
W. F. Luke, Schenectady, N. Y.....	Cont. 65	100 hr.		1657
Iowa Airplane Co., Des Moines, Iowa.....	8A Cont. 65	590 hr.		1650
Massey & Ransom Flyg. Serv., Denver, Colo.	Cont. 65	490 hr.		1650
Consol. Sch. Avia., E. St. Louis, Ill.....	Cont. 65	180 hr.		1650
Midwest Aviation Sales, LaGrange, Ill.....	Cont. 65	385 hr.	5 hr.	1550
Sundorph Aero Corp., Cleveland Arpt., O....	Cont. 50	65 hr.	none	1500
E.H.Brockenbrough,Mun.Arpt.,Charlotte,N.C...	Cont. 50	250 hr.	20 hr.	1500
Hudson Valley Aircraft, Middletown, N. Y...	Cont. 65	60 hr.		1450
Walz Corp., Central Arpt., Camden, N. J...	Cont. 50	235 hr.	none	1375
Queen City Flyg. Serv., Cincinnati, Ohio....	Cont. 50	469 eng. 402ship.		1250
Midwest Aviation Sales, LaGrange, Ill.....	Cont. 50	550 hr.	50 hr.	1250
Arents Air Ser., Armonk, N. Y.....	8 Cont. 50	200 hr.	200 hr.	1200
MONOCOACH				
Carnahan Flyg. Serv., Arpt., Bloomington, Ill.	Wright	998 hr.	165 hr.	995
Dewey Eldred Flyg. Serv., Willoughby, Ohio	Wright	1176 hr.	June '39	650
MONOCOUPE				
N. R. McCray, Jamestown, N. Y.....	Lambert 90	375 hr.	300 hr.	1750
Arents Air Serv., Armonk, N. Y.....	90A Lambert 90	400 hr.	225 hr.	1700
Cape Aircraft, Inc., Hatchville, Mass.....	Lambert 90	340 hr.	340 hr.	1550
Inter-City Airlines, East Boston, Mass.....	D-145 Warner 145	450 hr.	never	1500
Chicago Aviation, Curtiss Arpt., Glenview, Ill.	90 Lambert 90	495 hr.	420 hr.	1295
Aero Serv. Inc., McKinley Arpt., Canton, O..	125 Warner 125	800 hr.	100 hr.	1250
Sky Harbor, Inc., Indianapolis, Ind.....	Lambert	275 hr.	July '39	1200
Dupont Airport, Wilmington, Del.....	125 Kinner 125	320 hr.	19 hr.	1195
Oakland Aircraft, Alameda, Cal.....	Lambert 90	688 hr.	Feb. '39	850
Huron Flyg. Serv., Huron, So. Dakota.....	Lambert	788 hr.		695
MOTH				
Luscombe Airplane Corp., 247 Park, N. Y..	Gypsy Major	none	new	4000
Carl Evers, 247 Park Ave., New York, N. Y.	Gypsy 130	1 hr.		2900
Carl Evers, 247 Park Ave., New York, N. Y..	Gypsy 130	1 hr.		2900
A. J. Hartman, Burlington Arpt., Burlington, Iowa.....	90 hp	650 hr.		350
NEW STANDARD				
Oneal Aircraft, Vincennes, Ind.....	J-5	700 hr.	20 hr.	1550
NICHOLAS-BEAZLEY				
Dubuque Airways, Dubuque, Iowa.....	Genet 80	400 hr.	60 hr.	525
PARKS				
Hylan Flyg. Serv., Rochester, N. Y.....	Wright 175	514 hr.	150 hr.	1250

AUTHORIZED AIRCRAFT DEALERS

PIPER CUB

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Odessa Flyg. Serv., Odessa, Texas	J-4A	Cont.	110 hr.	none	$2150
D. H. Wallace, Clarcona, Fla	Coupe	Cont. 65	60 hr.	new	2000
W. B. Skelton, Greenville, Pa	J-4	Cont. 65	10 hr.	new	1995
Seidner Flyg. Serv., Sam Arpt., Youngst'n, O.	J-4A	Cont. 65	13 hr.	new	1995
W. Blood Aircraft Sales, Charleston, W. Va.	J-4	Cont. 65	75 hr.	new	1900
Lynchburg Air Corp., Lynchburg, Va	Coupe	Cont. 65	100 hr.	none	1900
Aviation Service, Inc., Newport News, Va		Cont.	70 hr.	none	1875
McBoyle Cub Sales, Spring Green, Wis	Coupe	Cont.	75 hr.	new	1850
Bennett Air Serv., Heightstown, N. J	J-4	Cont. 65	60 hr.		1850
Lynchburg Air Corp., Lynchburg, Va	Coupe	Cont. 65	105 hr.	none	1800
Des Moines Flyg. Serv., Des Moines, Ia	Coupe	Cont. 65	96 hr.	new	1775
Des Moines Flyg. Serv., Des Moines, Ia	Coupe	Cont. 65	87 hr.	new	1775
A. Young, Somerset Pike, Johnstown, Pa	Cruiser	Cont. 75	84 hr.		1750
Northern Air Serv., Grand Rapids, Mich	Cruiser	Cont. 75	15 hr.	new	1700
Matthews & Rappaport, Mineola, L. I., N. Y.	J-4	Cont. 65	125 hr.		1675
Bethany Air Serv., Inc., Bethany, Conn		Cont.	78 hr.		1650
Hudson Valley Aircraft, Middletown, N. Y		Cont. 65	28 hr.		1650
Krantz Aero Serv., Pt. Erie Arpt., Erie, Pa	Coupe	Cont. 65	110 hr.	110 hr.	1600
Woodlawn Balto. Co., Baltimore, Md	Coupe	Cont. 65	153 hr.		1595
Clovis Flyg. Serv., Clovis, N. M		Cont. 65	100 hr.	none	1575
Fredericksburg Air Serv., Fredericksburg, Va.	J-4	Cont. 65	450 hr.	15 hr.	1550
Southern Air Serv., Memphis, Tenn		Cont. 65	100 hr.	new	1550
B. A. Funk, Lambert Arpt., Robertson, Mo	Seaplane \ Landplane /	Frank. 50	700 hr.	525 hr.	1500
Bethany Air Serv., Bethany, Conn		Cont.	201 hr.		1500
Aircraft Associates, Long Beach, Cal	J-4	Cont. 50	150 hr.		1500
Seidner Flyg. Serv., Youngstown, Ohio	J-4	Cont. 65	92 hr.	new	1495
Hylan Flyg. Serv., Rochester, N. Y		Cont. 65	450 hr.	25 hr.	1450
Bennett Air Serv., Heightstown, N. J	J-4	Warner 125	270 hr.	50 hr.	1425
Camel City Flyg. Serv., Winston-Salem, N.C.	Coupe	Cont. 65	411 hr.	110 hr.	1400
W. Buel, 102 N. Main, Fremont, Neb	Coupe	Frank. 60	75 hr.	none	1400
Bennett Air Serv., Heightstown, N. J	J-4	Cont. 65	160 hr.		1395
E. H. Brockenbrough, Airport, Charlotte, N. C.	Coupe	Cont. 65	331 hr.	10 hr.	1350
Tennessee Aero Corp., Nashville, Tenn	Coupe	Cont. 50	48 hr.	none	1350
L. A. Musgrove, Morgantown, W. Va	Coupe	Cont. 65	150 hr.	none	1300
Carolina Aircraft Sales, Charlotte, N. C		Cont. 65	310 hr.	40 hr.	1298
Ted Brixius, Columbia, Mo	Coupe	Cont. 50	196 hr.	none	1295
J. L. Schroeder, Inc., Houston, Tex	J-3 Duster	Frank. 50	60 hr.	60 hr.	1250
J. L. Schroeder, Inc., Houston, Tex	J-4 Coupe	Frank. 60	330 hr.	74 hr.	1250
Camel City Flyg. Serv., Winston-Salem, N. C.	Coupe	Cont. 50	180 hr.	3 hr.	1250
Odessa Flyg. Serv., Odessa, Texas	J-3	Frank. 50	405 hr.	none	1250
A. Young, Somerset Pike, Johnstown, Pa	J-3	Frank. 60	135 hr.		1250
Bennett Air Serv., Heightstown, N. J	J-4	Cont. 50	120 hr.	10 hr.	1250
Barr Aviation Corp., Detroit, Mich		Cont. 65	230 hr.	none	1200
Northway Flyg. Serv., Columbus, Ohio	J-4	Frank. 60	350 hr.	yes	1200
Seidner Flyg. Serv., Youngstown, Ohio	Trainer	Frank. 60	27 hr.	new	1200
A. Gillis Flyg. Serv., Great Falls, Mont	J-3	Cont. 50	300 hr.	none	1200
Palm Beach Aero Corp., W. Palm Beach, Fla.	Coupe	Cont. 65	122 hr.		1195
Geo. C. Haven, Schenectady, N. Y		Frank. 50	25 hr.	none	1150
Maheux's Arpt., Inc., Auburn, Me	12 Seaplane	Cont. 40	347 hr.	yes	1150
A. Gillis Flyg. Serv., Great Falls, Mont	J-3	Frank. 50	110 hr.	none	1150
Aaron Flyg. Serv., Louisville, Ky		Frank. 50	85 hr.		1125
Wm. Rannells, Airport, Cumberland, Md	J3 Trainer	Frank. 60	250 hr.	none	1125
Odessa Flyg. Serv., Odessa, Texas	J-3	Frank. 50	864 hr.	169 hr.	1100
Eno Flyg. Serv., Fort Dodge, Ia	J-3	Lyc. 50	500 hr.		1100
Eno Flyg. Serv., Fort Dodge, Ia	J-3	Cont. 50	450 hr.	recently	1100
A. Gillis Flyg. Serv., Great Falls, Mont	J-3	Frank. 50	130 hr.	none	1100
West Coast Aircraft, Inglewood, Calif	J-3	Cont. 50	1250 hr.	none	1075
B. F. Hines, Mex.-Tex. Arpt., Hobbs, N. M		Frank.	350 hr.	50 hr.	1075
J. P. Hall, Airport, West Haven, Conn	J3 Trainer	Cont. 50	300 hr.	new mtr.	1050
Jersey Flyg. Serv., Oakland, N. J		Frank. 60	40 hr.	none	1050
W. Va. Air Serv., Clarksburg, W. Va		Frank. 50	80 hr.	none	1050
J. K. Hinson, Rutherford Fld., Woodlawn, Md.	J-3	Frank. 50	290 hr.		1050
Lane Aviation Corp., Cleveland, Ohio	Coupe	Cont. 50	125 hr.		1050
Ray Wilson, Inc., Parkhill Arpt., Denver, Colo.		Frank.	522 hr.	none	1030
Ray Wilson, Inc., Parkhill Arpt., Denver, Colo.		Frank.	523 hr.	none	1030
Elliott Flyg. Serv., De Witt, Ia	J-3	Lyc. 50	525 hr.		1000
Page Airways Inc., Rochester, N. Y		Lyc. 50	450 hr.	none	1000
Utah Pacific Airways, Inc., Ogden, Utah		Lyc. 55	575 hr.	575 hr.	1000
L. Dethloff, Airport, Willoughby, Ohio	J-3	Frank.	572 hr.	none	1000
North-West Jersey Air Serv., Clinton, N. J	J-3	Lyc. 50	165 hr.		1000
Speed's Flyg. Serv., Jackson Hts., N. Y	J-3	Cont. 50	650 hr.	30 hr.	1000
Lexington Flyg. Serv., Lexington, Ky		Frank.	180 hr.	none	995
Safair, Inc., Roosevelt Fld., Mineola, N. Y	J-3 (9)	Frank. 50	300-500 each		995 each
Lexington Flyg. Serv., Lexington, Ky		Lyc.	560 hr.	none	975
Consol. School Aviation, E. St. Louis, Ill		Frank. 50	300 hr.		975
Lynchburg Air Corp., Lynchburg, Va	Trainer	Frank. 50	400 hr.	none	975
Tennessee Aero Corp., Nashville, Tenn		Frank. 50	250 hr.		970
Airways, Inc., Waterville, Me		Frank. 50	240 hr.		950
P. D. Eyster, Tri-State Arpt., Angola, Ind.	J-3 (3)	Frank. 50	300 hr. each		950 each
Mississippi Airways, Jackson, Miss		Cont. 50	615 hr.	May '40	950
Frost Air Serv., W. Haven, Conn		Cont. 50	290 hr.	none	950
Northway Flyg. Serv., Columbus, Ohio	J-3	Cont. 50	325 hr.		950
Northway Flyg. Serv., Columbus, Ohio	J-3	Frank. 50	380 hr.		950
Aviation Serv., Newport News, Va		Lyc. 50	460 hr.	none	925
Wm. Rannells, Airport, Cumberland, Md	J3 Trainer	Frank. 50	500 hr.	none	925
R. Wilson Inc., Parkhill Arpt., Denver, Colo.		Frank.	640 hr.	none	910
Bethany Air Serv., Bethany, Conn		Lyc.	510 hr.	110 hr.	900
Southern Air Serv., Memphis, Tenn		Lyc. 50	300 hr.	new	900
Clinton Co. Arpt., De Witt, Ia		Frank.	525 hr.		900
Utah Pacific Airways, Inc., Ogden, Utah		Cont.50	500 hr.	25 hr.	$900
L-H Air Serv., Hatboro, Pa	Trainer	Frank. 50	350 hr.	50 hr.	900
L-H Air Serv., Hatboro, Pa	Trainer	Frank. 50	275 hr.	none	900
Aaron Flyg. Service, Louisville, Ky		Frank. 50	460 hr.	Jan. '40	895
Hood Aircraft Sales, Northampton, Mass		Cont. 50	375 hr.		895
J. C. Gendron, Ironwood, Mich	Sport J3	Frank. 50	325 hr.	50 hr.	895
Northway Flying Serv., Columbus, Ohio	J-3	Frank. 50	650 hr.		880
Aircraft Associates, Long Beach, Cal	J-2	Cont. 40	20 hr.		875
L. A. Musgrove, Morgantown, W. Va	J-3	Lyc. 50	325 hr.	10 hr.	850
Midwest Aviation Sales, LaGrange, Ill		Frank. 50	406 hr.	60 hr.	850
Jersey Flyg. Serv., Oakland, N. J		Frank. 50	265 hr.	5 hr.	850
W. Va. Air Serv., Clarksburg, W. Va		Cont. 40	119 hr.	none	845
Ranger Flyg. Serv., Ranger, Texas	J3F	Frank. 50	775 hr.	July '40	825
Ranger Flyg. Serv., Ranger, Texas	J3F	Frank. 50	1000 hr.	Apr. '40	800
Ranger Flyg. Serv., Ranger, Texas	J3F	Frank. 50	775 hr.	May '40	800
Rocky Mount Flyg. Serv., Rocky Mount, N. C.		Cont. 40	215 hr.	215 hr.	800
Jenkins Air Serv., Rochester, N. Y		Cont. 40	450 hr.	25 hr.	775
Clinton County Arpt., DeWitt, Ia		Cont. 40	550 hr.		750
Zimmerly Bros., Lewiston, Idaho	J-3	Cont. 40	1335 hr.	1242 hr.	750
Elliott Flyg. Serv., De Witt, Ia	J-3	Cont. 40	550 hr.		750
A. Whitaker, Swan Is. Arpt., Portland, Ore.	J-2	Cont. 40	500 hr.	none	750
United Flyers Inc., Ridgewood, N. J	J-3	Cont. 40	200 hr.		750
Ranger Flyg. Serv., Ranger, Texas	J3F	Frank. 50	1100 hr.	Jan. '40	750
A. Gillis Flyg. Serv., Great Falls, Mont	J-2	Cont. 40	350 hr.	none	750
Blvd. Arpt., Inc., Red Lion Rd., Phila., Pa	J-2	Cont. 40	250 hr.	none	700
Peoria Aero Sales, Peoria, Ill		A-40-4	525 hr.	150 hr.	700
L. E. Smith, Sterling, Colo	J3 Sport	Cont. 40	325 hr.	ust	700
Hudson Valley Aircraft, Middletown, N. Y.		Cont. 40	300 hr.		700
J. K. Hinson, Rutherford Fld., Woodlawn, Md.	J-3	Cont. 40	316 hr.	50 hr.	695
Woodlawn Balto Co., Baltimore, Md	J-3	Cont. 40	376 hr.	120 hr.	695
W. T. Anderson, Lincoln Park, N. J	J-3	Cont. 40	270 hr.	33 hr.	695
A. Young, Somerset Pike, Johnstown, Pa	J-2	Cont. 40	720 hr.	uly '40	675
G.Moonoogian,AllstateArways.,Haverhill,Mass.	J-3	Cont. 40	700 hr.	50 hr.	675
A. Whitaker, Swan Is. Arpt., Portland, Ore.	J-2	Cont. 40	895 hr.	50 hr.	675
J. P. Hall, Airport, West Haven, Conn	J2 Trainer	Cont. 40	400 hr.	ow	675
Calkins Arcft.,1022 N.Atlantic,Seattle, Wash.		Cont. 40	800 hr.	17 hr.	675
Oakland Arcft, Alameda, Cal	J-2	Cont. 40	1785 hr.	May '40	665
Allied Arcft, Davenport, Ia		Cont. 40	385 hr.	100 hr.	650
Bayside Flyg. Serv., Hingham, Mass	J-3	Cont. 40	800 hr.	110 hr.	650
Carolina Arcft. Sales, Charlotte, N. C		Cont. 40	491 hr.	60 hr.	650
Harrisburg Air Serv., Harrisburg, Pa		Cont.	200 hr.	8 hr.	650
Calkins Arcft.,1022 N.Atlantic,Seattle,Wash.		Cont. 40	1467 hr.	138 hr.	650
Jones Flyg. Serv., Columbus, Ohio	J-3	Cont. 40	700 hr.	400 hr.	650
W. Va. Air Serv., Inc., Clarksburg, W. Va.		Cont. 40	490 hr.	35 hr.	645
Frost Air Serv., West Haven, Conn		Cont. 40	355 hr.	ecently	625
G. Moonoogian, Allstate Arway., Haverhill Mass	J-2	Cont. 40	625 hr.	50 hr.	575
Calkins Arcft.,1022 N.Atlantic, Seattle, Wash.	J-2	Cont. 40	854 hr.	263 hr.	625
J. L. Schroeder, Inc., Houston, Tex	J-3	Cont. 40	580 hr.	3 hr.	625
Hawthorne Flyg. Serv., Charleston, W. Va.	J-2	Cont. 40	700 hr.	200 hr.	600
G. E. Moon, Airport, Mishawaka, Ind	J-2	Cont. 40	150 hr.	one	600
Fox Valley Flyg. Serv., Aurora, Ill		Cont.	850 hr.	150 hr.	600
Southern Arways., Mun. Arpt., Birmingham, Ala.	J-2	Cont. 40	600 hr.		600
J. A. Field, 17 Forman St., Bradford, Pa	J-2	Cont. 40	315 hr.	5 hr.	600
Bayside Flyg. Serv., Hingham, Mass	J-2	Cont. 40	850 hr.	50 hr.	595
West Coast Aircraft, Inglewood, Calif	J-2	Cont. 40	250 hr.	250 hr.	595
Krantz Aero Serv., Pt. Erie Arpt., Pt. Erie, Pa.	J-2	Cont. 40	525 hr.	125 hr.	585
Wm. Rannells, Airport, Cumberland, Md	J2 Trainer	Cont. 40	600 hr.	500 hr.	575
J. L. Schroeder, Inc., Houston, Texas	J-2	Cont. 40	700 hr.		575
D. Rohn, 1300 Monroe, Beardstown, Ill		Cont. 40	500 hr.		575
Denny-Daitz Flyg. Corp., Mineola, N. Y	E-2	Cont. 40	300 hr.	Mar. '40	550
Chas. Roberts, Mun. Arpt., Dothan, Ala		Cont. 40	400 hr.	Mar. '40	550
Rocky Mount Flyg. Serv., Rocky Mount, N. C.		Cont. 40	650 hr.	40 hr.	550
McBoyle Cub Sales, Spring Green, Wis	J-2	Cont.	480 hr.	June '40	550
W. Blood Aircraft Sales, Charleston, W. Va.	J-2	Cont. 40	560 hr.	80 hr.	525
D. H. Wallace, Clarcona Fla	J-2	Cont. 40	500 hr.	Apr. '40	500
Virginia Cub Dist., Farmville, Va	J-2	Cont.	800 hr.	yes	500
Aviation Service, Hartford, Conn	E-2	Cont. 40	998 hr.	283 hr.	500
Aviation Service, Hartford, Conn	E-2	Cont. 40	323 hr.	285 hr.	500

PITCAIRN

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Blvd. Arpt., Inc., Roosevelt Blvd., Phila., Pa		Wright 240	354 hr.	none	1800

PORTERFIELD

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Lenhart Flyg. Serv., Mun. Arpt., Marion, Ind.		Warner 90	197 hr.		1500
Speed's Flyg. Serv., Holmes Arpt., Jackson Hts., N. Y		Cont. 50	105 hr.		1200
Bethany Air Serv.,Inc.,Amity Rd.,Bethany,Conn.		LeBlond	178 hr.		900
Livingston Airways, Waterloo, Ia		LeBlond 70			895
Geo. C. Haven, Schenectady, N. Y		LeBlond 70	450 hr.	100 hr.	895
W. F. Luke, Schenectady, N. Y		LeBlond 70	450 hr.	100 hr.	800
S. P. Hale, Jr., 309 F St., Ardmore, Ohio	Flyabout	LeBlond 70	750 hr.		775
Aircraft Associates, Long Beach, Cal	35-70	LeBlond 70	566 hr.	424 hr.	750
Dawson Air Serv., Salina, Kans		LeBlond	not given	Apr. '40	695
Decatur Aviation, Decatur, Ill	Zephyr	Cont. 40	130 hr.		625
Hood Aircraft Sales, Northampton, Mass		LeBlond	700 hr.	just topped	595
Airways, Inc., Waterville, Me		Cont. 40	88 hr.	new shp.	595
Currey Flyg. Serv., Galesburg, Ill	Zephyr	Cont. 40	500 hr.	40 hr.	550

FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE	TIME	OVER-HAULED	PRICE
REARWIN				
Falcon Aircraft, L. A. Mun. Arpt., Inglewood, Cal.	Speedster Menasco 125	150 hr.		$2250
Falcon Aircraft, L. A. Mun. Arpt., Inglewood, Cal.	Sportster LeBlond 90	450 hr.	recently	1700
California Aircraft, Van Nuys, Cal.	Sportster LeBlond 90	469 hr.		1675
St. Louis Flyg. Serv., Lambert Fld., St. Louis, Mo.	Sportster LeBlond 70	505 hr.		1495
E. W. Wiggins Airways, Providence, R. I.	LeBlond 90	400 hr.	130 hr.	1400
A. E. Padage, Tri-City Arpt., Wisc. Rapids, Wis.	90 LeBlond	178 hr.	73 hr.	1350
Midwest Aviation Sales, LaGrange, Ill.	LeBlond 90	338 hr.	50 hr.	1250
Four Lakes Aviation, Madison, Wisc.	7000 LeBlond 70	300 hr.		1150
Jennings Bros., No. Grafton, Mass.	LeBlond 70	680 hr.	50 hr.	1075
Airways, Inc., Waterville, Me.	LeBlond 85	280 hr.	new ship	1000
P. A. Meinke, Willoughby, O.	LeBlond 85			950
E. H. Brockenbrough, Mun. Arpt., Charlotte, N.C.	70 LeBlond	635 hr.	600 hr.	950
Akron Airways, Inc., Akron, O.	8500 LeBlond 85	850 hr.	280 hr.	950
Racine Flyg. Serv., Inc., Racine, Wisc.	LeBlond 70	550 hr.	3 hr.	925
Aircraft Asso., Mun. Arpt., Long Beach, Cal.	7000 LeBlond 70	1712 hr.	1615 hr.	900
N. R. McCray, Airport, Jamestown, N. Y.	LeBlond 70	890 hr.	760 hr.	895
Chgo. Aviation, Curtiss Arpt., Glenview, Ill.	70 LeBlond 70	490 hr.	400 hr.	850
ROBIN				
Utah Pacific Airways, Inc., Ogden, Utah.	J-6-5	1075 hr.	25 hr. eng.	1100
Raymond Aero. Service Co., Macon, Ga.	Wright	800 hr.	Nov. '39	950
Clovis Flyg. Serv., Clovis, N. M.	J-6-5	600 hr.	Feb. top	850
Fox Valley Flyg. Serv., Aurora, Ill.	Chall.	870 hr.	35 hr.	575
ROMAIR				
A'rc'ft Asso., Mun. Arpt., Long Beach, Cal.	Duster Wright J-5			800
RYAN				
Mid-Western Aviation Co., St. Joseph, Mo.	B-1 J-5-220	630 hr.	8 hr.	995
J. L. Schroeder, Inc., Houston, Texas.	Wright 225	634 hr.	21 hr.	875
J. O. Dockery, Stuttgart, Ark.	J-5	600 hr.	100 hr.	850
Oneal Aircraft, Vincennes, Ind.	J-5	950 hr.	200 hr.	850
SECURITY				
Aviation Service Co., Hartford, Conn.	S1A Kinner 100	940 hr.	146 hr.	850
Aviation Service Co., Hartford, Conn.	S1A Kinner 100	936 hr.	165 hr.	850
SIKORSKY				
E. W. Wiggins Airways, Providence, R. I.	S-39	400 hr.	recently	7500
Palm Beach Aero, Morrison Fd., W. Palm Beach, Fla.	S38B Wasp 450	125 hr.	yes	5995
Gilpin Airlines, Tucson, Ariz.	Wasp 375		300 hr.	5500
Carl Evers, 247 Park Ave., N. Y., N. Y.	Wasp jr. 330	850 hr.	150 hr.	4000
STATES				
Red Bank Airport, Inc., Red Bank N. J.	Kinner 100	450 hr.	75 hr.	695
SPARTAN				
Spartan School of Aero, Tulsa, Okla.	C-3 Wright 1652	634 hr.	Aug. '40	950
Wichita Falls, Air Trans., Wichita Falls, Tex.	Wright 240	330 hr.	110 hr.	900
Spartan School of Aero, Tulsa, Okla.	C-3 Wright 225	927 hr.	new	850
Spartan School of Aero, Tulsa, Okla.	C-3 Wright 1652	100 hr.	new	850
St. Louis Flyg. Serv., Lambert Fld., St. Louis, Mo.	Wright J65	505 hr.	242 hr.	845
H. C. Nelson, 3322 Abner Pl., St. Louis, Mo.	Wright	420 hr.	April '35	845
Spartan School of Aero, Tulsa, Okla.	C-4 Wright 225	852 hr.	Apr. '38	800
Narragansett Aviation, Hillsgrove, R.I.	L3 Jacobs 55	1500 hr.	none	695
SPORTWING				
Oakland Aircraft, Alameda, Calif.	Kinner 125	640 hr.	Jan. 40	2400
Fredericksburg Air Serv., Fredericksburg, Va.	Kinner 125	900 hr.	200 hr	1650
Safair, Inc., Roosevelt Field, Mineola, N. Y.	Kinner 125	2400 hr.	Dec. '39	850
STANDARD				
Pete Grim, R.F.D. No. 4, Staunton, Va.	D29A Kinner B5	1249 hr.	57 hr.	975
Inter-City Flyg. Serv., Ft. Wayne, Ind.	2 place Kinner	490 hr.	4 hr.	925
STEARMAN				
Upton & Bowen, West Memphis, Ark.	J69-330	500 hr.	50 hr.	1800

DEALERS	MODEL AND ENGINE	TIME	OVER-HAULED	PRICE
STINSON				
Sioux Skyways, Sioux Falls, S. Dak.	Lyc. 260	235 hr.	235 hr.	$7200
Hyannis Arpt. Corp., Hyannis, Mass.	SR-9-ED Lyc. 245	320 hr.	none	6000
Air Serv., Inc., Mun. Arpt., Denver, Colo.	Wright 285	386 hr.	40 hr.	5900
Air Service, Inc., Mun. Arpt., Denver, Colo.	Reliant Wright	386 hr.	40 hr.	5900
Camel City Flyg. Serv., Winston-Salem, N. C.	Reliant Lyc. 245	889 hr.	245 hr.	4680
P. J. Sones, Haines City, Fla.	SR-9-CD Lyc. 260	510 hr.	110 hr.	4500
Inter-City Airlines, E. Boston, Mass.	SR-8-D Wright 285	670 hr.	110 hr.	4250
P. J. Sones, Haines City, Fla.	SR-9B Lyc. 245	630 hr.	230 hr.	4250
Narragansett Aviation, Hillsgrove, R. I.	105 Cont. 80	150 hr.	none	3695
Franklin Rose Aircraft, Alameda, Cal.	10 Cont. 80	225 hr.		3650
Franklin Rose Aircraft, Alameda, Cal.	10 Cont. 80	50 hr.		3450
J. A. Atherton Co., St. Paul, Minn.	Cont. 80	40 hr.		3295
Portland Flyg. Serv., Portland, Me.	105 80 hp	110 hr.	none	3250
Akron Airways, Inc., Akron, Ohio.	105 Cont. 80	60 hr.	none	3000
Chgo. School of Aero., Mt. Prospect, Ill.	SR-6B Lyc. 245	970 hr.	100 hr.	2995
Chicago Aviation Corp., Glenview, Ill.	Lyc. 245	1000 hr.	300 hr.	2800
S. P. Hale, Jr., 309 F St., Ardmore, Ohio.	105 Cont. 75	160 hr.	just	2650
R. Turner Aero Corp., Indianapolis, Ind.	Cont. 75	165 hr.	none	2600
Geo. C. Haven, Schenectady, N. Y.	Cont. 75	90 hr.	none	2550
Sioux Skyways, Sioux Falls, S. Dak.	Cont. 75	225 hr.	25 hr.	2500
Genl. Aero. Corp., 1717 Ford Bldg., Detroit, Michigan	105 Cont. 75	96 hr.		2450
Air Serv. Inc., Mun. Arpt., Denver, Colo.	105 Cont. 75	120 hr.		2400
Jenkins Air Serv., Inc., Rochester, N. Y.	Cont. 75	170 hr.		2350
Upton & Bowen, W. Memphis, Ark.	105 Cont. 75	250 hr.	50 hr.	2350
P. J. Sones, Haines City, Fla.	SR-6B Lyc. 245	565 hr.	165 hr.	2350
Chgo. School of Aero, Mt. Prospect, Ill.	105 Cont. A-75	390 hr.	370 hr.	2345
G. L. Williams, Syracuse Arpt., Syracuse, N.Y.	Cont. 75	200 hr.		2300
G. L. Williams, Syracuse Arpt., Syracuse, N.Y.	105 Cont. 75	225 hr.		2300
Franklin Rose Aircraft, Alameda, Cal.	SR5 Lyc. 260	2500 hr.	July '40	2250
Hangar Six, Inc., Stinson Bldg., San Antonio, Tex.	105 Cont. 75	267 hr.	none	2250
P. J. Sones, Haines City, Fla.	105 Cont. 75	220 hr.	none	2250
Bishop Flyg. Serv., Bishop Arpt., Flint, Mich.	105 Cont. 75	140 hr.	40 hr.	2250
Raymond Aero Serv. Co., Airport, Macon, Ga.	Wasp Jr.	950 hr.	Mar. '38	2000
Genl. Aero. Corp., 1717 Ford Bldg., Detroit, Michigan	105 Cont. 75	635 hr.	162 hr.	1975
Genl. Aero. Corp., 1717 Ford Bldg., Detroit Michigan	105 Cont. 75	708 hr.	289 hr.	1975
Morey Airplane Co., Madison, Wisc.	Lyc.	800 hr.	350 hr.	1900
Hume & Smyer, Arkansas City, Kansas.	SR6 Lyc. 245	510 hr.	180 hr.	1875
J. Frank Wilson, New Kingstown, Pa.	SR-SR Lyc. 225	650 hr.	450 hr.	1800
Miller Flyg. Serv., North Benton, Ohio.	Lyc. 225	565 hr.	May '39	1800
Page Airways, Inc., Rochester, N. Y.	Lyc.	1500 hr.	250 hr.	1750
Eno Flyg. Serv., Fort Dodge, Iowa.	SR5A Lyc. 245	1100 hr.	250 hr.	1700
Eno Flyg. Serv., Fort Dodge, Iowa.	SR5 Lyc. 245	950 hr.	yes	1650
Moberly Flyg. Serv., Mobely, Mo.	Lyc.	1220 hr.	30 hr.	1650
J. L. Schroeder, Inc., Houston, Tex.	SR Lyc. 215	460 hr.	none	1500
Brayton Flyg. Serv., Robertson, Mo.	Lyc.	738 hr.	126 hr.	1450
Chgo. School of Aero, Mt. Prospect, Ill.	Reliant Lyc. 215	1100 hr.	350 hr.	1445
Harrisburg Air Serv., Harrisburg, Pa.	Lyc.	700 hr.	175 hr.	1300
Canton Aviation Co., Canton, Ohio.	Lyc. 215		yes	1200
Springfield Aviation, Springfield, Ill.	SM-8A Lyc. 215	760 hr.	360 hr.	1175
R. F. Turner, Airport, Spartanburg, S. C.	S Lyc. 680	800 hr.	150 hr.	1150
Neiderhauser Airways, Marshalltown, Ia.	Lyc.	1350 hr.	40 hr.	1100
Carolina Aircraft Sales, Charlotte, N. C.	Lyc.	832 hr.	9 hr.	1000
York Airport, Thomasville, Pa.	SM-8A Lyc. 215	1550 hr.		1000
Odessa Flyg. Serv., Odessa, Texas.	SM-2AB Wright 220	1767 hr.	none	1000
F. D. Eyster, Tri-State Arpt., Angola, Ind.	SM-8A Lyc. 215	1200 hr.	200 hr.	1000
Four Lakes Aviation, Madison, Wis.	SM-2AA Wright 65	485 hr.	85 hr.	1000
C. A. Lewis, 776 S. Maffit St., Decatur, Ill.	SMIF Wright 330	805 hr.	220 hr.	1000
Maheux's Airport, Inc., Auburn, Me.	SM-8A Lyc. 215			995
G & R Air Serv., 600 N. Columbus, Alexandria, Va.	Lyc. 215	1250 hr.	105 hr.	950
Barr Aviation Corp., Detroit, Michigan.	Lyc. 215	890 hr.	5 hr. eng.	950
Decatur Aviation Co., Decatur, Ill.	SMIF Wright 69	805 hr.	240 hr.	895
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	S Lyc. 215	1500 hr.	100 hr.	850
Northway Flyg. Serv., Norton Fld., Columbus, O.	SM2AB Wright 220	1200 hr.	Dec. '39	775
STUDENT PRINCE				
Buroker-Hicks Flyg. Serv., Olympia, Wash.	2-POLB Cirrus 100	650 hr.	none	800
Tacoma Flyg. Serv., South Tacoma, Wash.	Cirrus 100	650 hr.	125 hr.	850
TAYLORCRAFT				
J. P. Hall, Airport, West Haven, Conn.	Cont. 65		none	2000
C. H. Kenyon, Grand Mere, Quebec.	Lyc. 55	93 hr.	none	1900
C. R. Galloway, 3006 Hardie, Ft. Smith, Ark.	BC-65 Cont. 65	120 hr.	none	1800
United Flyers, Inc., Ridgewood, N. J.	BL deluxe Lyc. 65	165 hr.		1750
Leavens Bros., Barker Arpt., Toronto, Can.	Cont. 50	614 hr.		1750
Bishop Flyg. Serv., Flint, Mich.	Cont. 65	110 hr.		1700
Carnahan Flyg. Serv., Mun. Arpt., Bloomington, Ill.		125 hr.		1700
Washington Pk. Arpt., Homewood, Ill.	Cont. 65	150 hr.	none	1650
Inter-City Flyg. Serv., Ft. Wayne, Ind.	BC-65 Cont. 65	256 hr.	none	1640
Neiderhauser Airways, Marshalltown, Ia.	Lyc. 65	50 hr.	new	1600
L. E. Daniels, Crete, Ill.	Cont. 65	175 hr.	none	1595
Narragansett Aviation, Hillsgrove, R. I.	Cont. 65	450 hr.	none	1595
Rochester Aero Corp., Rochester, N. Y.	Lyc.	250 hr.		1500
Fox Valley Flyg. Serv., Aurora, Ill.	Lyc. 65	125 hr.		1500
Ed. Nibur, Madiera Arpt., Bernharts, Pa.	Cont. 65	385 hr.		1500
Merrill Hale, Hillsgrove, R. I.	Cont. 65	490 hr.		1495

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Fox Valley Flyg. Serv., Aurora, Ill.		Lyc. 65	106 hr.		$1475
Ed. Nibur, Madiera Arpt., Bernharts, Pa.		Lyc. 55	120 hr.		1450
Four Lakes Aviation, Madison, Wisc.	BL	Lyc. 65	399 hr.	30 hr.	1450
Gilpin Airlines, Tucson, Ariz.		Cont. 50	350 hr.	none	1450
Aviation Country Club, Cedar Rapids, Ia.	BF	Frank. 50	110 hr.		1450
C. E. Dufort, Malone Arpt., Malone, N. Y.	BL	Lyc. 55	50 hr.	new	1400
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 50	85 hr.	none	1390
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 50	104 hr.	none	1375
Fred Helm, Zap, No. Dakota	BF	Frank. 50	170 hr.	none	1375
Athens Flyg. Serv., Athens, Ga.	BC 38	Cont. 50	418 hr.	385 hr.	1350
L. E. Daniels, Crete, Ill.	BT	Lyc. 50	125 hr.	none	1325
L. E. Daniels, Crete, Ill.	BT	Lyc. 50	102 hr.	none	1325
Reifenberg Aviation, St. Johns, Pa.		Lyc. 55	138 hr.		1325
Inter-City Flyg. Serv., Ft. Wayne, Ind.	65 deluxe	Cont. 65	500 hr.	50 hr.	1300
C. R. Galloway, 3006 Hardie, Ft. Smith, Ark.	B665	Cont. 65	600 hr.		1300
L. A. Musgrove, Morgantown, W. Va.	BL	Lyc. 50	300 hr.	50 hr.	1050
Peoria Aero Sales, Peoria, Ill.		Lyc.	140 hr.	none	1300
Aviation Country Club, Cedar Rapids, Ia.	BC	Cont. 50	318 hr.	18 hr.	1300
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 55	235 hr.	none	1295
Ryan Air Serv., Decorah, Ia.		Lyc. 50	295 hr.		1250
K. Johannesson Flyg. Serv., Winnipeg, Can.		Cont. 40	800 hr.		1250
Raymond Aero Serv., Macon, Ga.		Lyc.	685 hr.	Mar. '40	1250
Hubert & Dillon Air Serv., Tacoma, Wash.	B	Lyc. 55	1150 hr.	just	1250
Balt. School of Aero, Baltimore, Md.		Lyc.	341 hr.		1200
Four Lakes Aviation, Madison, Wisc.	BL	Lyc. 50	490 hr.	none	1200
Little Corp., Patco Fld., Norristown, Pa.	B	Lyc. 55	100 hr.	none	1200
Inter-City Flyg. Serv., Ft. Wayne, Ind.	50 deluxe	Frank. 50	400 hr.	100 hr.	1200
R. Turner Aero Corp., Indianapolis, Ind.		Frank. 50	247 hr.	top	1200
Greenville Sch. of Avia., Greenville, Ohio.		Lyc. 145	232 hr.	June '40	1200
Dubuque Airways, Dubuque, Ia.	BL	Lyc. 50		none	1200
Hubert & Dillon Air Serv., Tacoma, Wash.	B	Cont. 50	1200 hr.	yes	1200
L. E. Daniels, Crete, Ill.		Lyc. 55	300 hr.	none	1195
J. Frank Wilson, New Kingstown, Pa.	BL	Lyc. 55	250 hr.		1185
J. P. Hall, Airport, West Haven, Conn.	B	Lyc. 50	300 hr.	now	1175
Hubert & Dillon Air Serv., Tacoma, Wash.	A	Cont. 40	650 hr.	yes	1150
United Flyers, Ridgewood, N. J.	BF	Frank. 50	220 hr.		1150
Hopewell Flyg. Serv., Hopewell, Va.		Frank. 50	275 hr.	none	1150
A. J. Moore, 324 State St., Baden, Pa.		Lyc. 55	435 hr.	40 hr.	1150
Schneider Aero Serv., Fresno, Cal.		Cont. 50	737 hr.	49 hr.	1150
Canton Aviation, Canton, Ohio.		Lyc. 50	291 hr.	yes	1150
Raymond Aero Serv., Macon, Ga.		Cont.	550 hr.	Nov. '39	1150
Canton Aviation, Canton, Ohio.	BL deluxe	Lyc. 50	300 hr.		1100
Rochester Aero Corp., Rochester, N. Y.		Lyc.	475 hr.	25 hr.	1100
Neiderhauser Airways, Marshalltown, Ia.		Lyc. 55	300 hr.	yes	1100
Gilpin Airlines, Tucson, Ariz.		Cont. 50	800 hr.	none	1100
Narragansett Aviation, Hillsgrove, R. I.		Frank. 50	270 hr.	none	1095
Dubuque Airways, Dubuque, Ia.	BL	Lyc. 50	600 hr.	100 hr.	1050
L. A. Musgrove, Morgantown, W. Va.	BL	Lyc. 50	300 hr.	50 hr.	1050
Bishop Flyg. Service, Flint, Mich.		Frank. 50	1150 hr.	975 hr.	1050
C. E. Dufort, Malone Arpt., Malone, N. Y.	BF	Frank. 50	550 hr.	60 hr.	1050
Merrill Hale, Hillsgrove, R. I.		Frank. 50	268 hr.	35 hr.	1050
Dewey Eldred Flyg. Serv., Willoughby, Ohio		Lyc. 55	400 hr.		1000
Dewey Eldred Flyg. Serv., Willoughby, Ohio		Frank. 50	450 hr.		1000
Dubuque Airways, Dubuque, Ia.	BF	Frank. 50	400 hr.		950
E. D. Lyon, RD No. 1, Warren, Ohio.		Lyc. 50	500 hr.	yes	895
Hood Aircraft Sales, Northampton, Mass.		Cont. 40	550 hr.	125 hr.	850
B. A. Funk, Robertson, Mo.	Model A	Cont. 40			850
W. F. Luke, Airport, Schenectady, N. Y.		Frank. 50	350 hr.		825
Jennings Bros., No. Grafton, Mass.		Cont. 40	660 hr.	100 hr.	800
Hubert & Dillon Air Serv., Tacoma, Wash.	A	Cont. 40	950 hr.	yes	800
Little Corp., Patco Fld., Norristown, Pa.	A	Cont. 40	100 hr.	none	800
Aviation Country Club, Cedar Rapids, Ia.	A	Cont. 40	685 hr.	June '40	800
Sioux Skyways, Sioux Falls, So. Dakota		Cont. 40	600 hr.	65 hr.	785
A. Whitaker, Swan Is. Arpt., Portland, Ore.		Cont. 40	995 hr.	65 hr.	775
O. L. Hostetter, York Arpt., Thomasville, Pa.	A	Cont. 40	560 hr.	130 hr.	775
Stinson Flyg. Corp., Glendale, Calif.		Cont. 40	1100 hr.	170 hr.	760
Buroker-Hicks Flyg. Serv., Olympia, Wash.	A-2PCLM	Cont. 40	450 hr.	none	750
Little Corp., Patco Fld., Norristown, Pa.	A	Cont. 40	200 hr.	160 hr.	750
Athens Flyg. Serv., Athens, Ga.	38	Cont. 40	618 hr.	560 hr.	750
L. A. Musgrove, Morgantown, W. Va.	A	Cont. 40	375 hr.	125 hr.	750
Dawson Air Serv., Salina, Kans.		Cont. 40	500 hr.	recently	750
Ryan Air Service, Decorah, Ia.		Cont. 40	326 hr.		750
United Flyers Inc., Ridgewood, N. J.	A	Cont. 40	250 hr.		750
Sky Harbor, Inc., Indianapolis, Ind.	A'	Cont. 40	521 hr.	Aug. '39	750
E. W. Wiggins Airways, Providence, R. I.		Cont. 40	650 hr.	none	735
A. R. Smith, 113 E. Commerce, Aberdeen, Md.		Cont. 40	850 hr.	Oct. '39	725
Livingston Airways, Waterloo, Ia.		Cont. 40	825 hr.		700
Carnahan Flyg. Ser., Bloomington, Ill.		Cont. 40	507 hr.	100 hr.	700
Merrill Hale, Hillsgrove, R. I.		Cont. 40	1081 hr.	100 hr.	695
Springfield Aviation, Springfield, Ill.	A	Cont. 40	298 hr.		675
J. F. Whickir, Mun. Arpt., Ft. Wayne, Ind.		Cont. 40	430 hr.		675
J. L. Wells, 106 W. Main, Avon Park, Fla.		Cont. 40	690 hr.	100 hr.	650
Inter-City Flyg. Serv., Ft. Wayne, Ind.	Deluxe	Cont. 40	400 hr.	none	650
Dewey Eldred Flyg. Serv., Willoughby, O.		Cont. 40	350 hr.		650
Dennison Arpt. Oper., Quincy, Mass.	A	Cont. 40	900 hr.	5 hr.	650
Aero Serv., McKinley Arpt., Canton, O.	A	Cont. 40	600 hr.	200 hr.	650
Somerset Hills Arpt., Basking Ridge, N. J.		Cont. 40	180 hr.		650
Sky Sport Assn., Inc., Sharonville, Ohio.		Cont. 40	975 hr.	192 hr.	650
United Flyers, Inc., Ridgewood, N. J.	A	Cont. 40	460 hr.	20 hr.	625
Palm Beach Aero Corp., W. Palm Beach, Fla.		Cont. 40	238 hr.		595
Hobley-Maynard Air Ser., New Orleans, La.		Aero. 36	750 hr.	Jan. '40	550
TRAVELAIR					
Bayside Flyg. Serv., Hingham, Mass.	6000	Wright 330	1600 hr.	25 hr.	1795
California Aircraft, Van Nuys, Calif.	A-14-D	Wright 240	1082 hr.	20 hr.	1750

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Ray Wilson, Inc., Parkhill Arpt., Denver, Col.	4000	Wright 225	3800 hr.	17 hr.	$1650
Ray Wilson, Inc., Parkhill Arpt., Denver, Col.	4000	Wright 225	1146 hr.	21 hr.	1600
Ray Wilson, Inc., Parkhill Arpt., Denver, Col.		Wright J5	608 hr.	81 hr.	1600
E. W. Wiggins Airways, Norwood, Mass.		S-6000-B	1000 hr.	recently	1600
A. Whitaker, Swan Is. Arpt., Portland, Ore.	4-D	Wright J6-7	860 hr.	110 hr.	1550
A. Whitaker, Swan Is. Arpt., Portland, Ore.	K	Kinner B-5	1250 hr.	110 hr.	1350
Jones Flyg. Serv., Columbus, Ohio.		Wright J-5	500 hr.	May '38	1250
J. A. Field, 17 Forman, Bradford, Pa.	J-5	Wright 225	1000 hr.	recently	1250
Sky Harbors, Inc., Indianapolis, Ind.		Wright	600 hr.	80 hr.	1200
J. Frank Wilson, New Kingstown, Pa.	E-4000	Wright 175	750 hr.	60 hr.	1185
Akron Airways, Inc., Akron, Ohio.	4000	Wright 220	740 hr.	290 hr.	1050
Ray Porter, Chagrin Arpt., Willoughby, O.	C-4000	Chall. 185	650 hr.	just	1000
Odessa Flyg. Serv., Odessa, Texas.	4000	Wright 220	506 hr.	489 hr.	1000
Northern Air Serv., Grand Rapids, Mich.	4000	Wright J5	762 hr.	yes	975
Northway Flyg. Serv., Columbus, Ohio.		Wright 220	1100 hr.		950
Bayside Flyg. Serv., Hingham, Mass.	10-D	Wright 250	700 hr.	40 hr.	900
Blvd. Arpt., Inc., Red Lion Rd., Phila., Pa.		Gypsy 90	369 hr.	5 hr.	900
Racine Flyg. Serv., Racine, Wisc.		Gypsy	172 hr.	none	900
Leeward Aircraft, New Kensington, Pa.	C-4000	Chall. 185	718 hr.	13 hr.	885
D. Schall, 33 Claggett Rd., Hyattsville, Md.	Sport	Wright 90	600 hr.	80 hr.	875
A. Whitaker, Swan Is. Arpt., Portland, Ore.		Wright J5A	558 hr.	110 hr.	875
Stinson Flyg. 1044 Airways, Glendale, Cal.	4000	Wright 220	750 hr.	100 hr.	850
North-West Jersey Air Serv., Clinton, N. J.	C-4000	Chall. 185	310 hr.	yes	850
Hudson Valley Aircraft, Middletown, N. Y.		Kinner 100	800 hr.		750
Hudson Valley Aircraft, Middletown, N. Y.		Kinner 100	800 hr.	3 hr.	750
Dupont Airport, Wilmington, Del.	E-4000	Wright 175	830 hr.		745
V. S. King, Warren Arpt., Warren, Pa.	2000	Tank 73	708 hr.	29 hr.	675
Currey Flyg. Serv., Galesburg, Ill.	900	Siemans 128		now	600
WACO					
E. W. Wiggins Airways, Providence, R. I.	N	285 hp	325 hr.	none since	6500
Warsaw Air Serv., Warsaw, Ind.	Custom	Jacobs 285	200 hr.		4950
Sundorph Aero, Airport, Cleveland, O.	Custom	Jacobs 285	350 hr.	now	4500
A. E. Padage, Wisconsin Rapids, Wisc.	Custom	Jacobs 285	360 hr.	40 hr.	4500
Falcon Aircraft, Inglewood, Cal.	F-7	Jacobs 285	140 hr.		4250
A. Young, Somerset Pike, Johnstown, Pa.	Cabin	Jacobs 225	276 hr.	new	3750
E. W. Wiggins Airways, Providence, R. I.	S	Jacobs 225	740 hr.	40 hr.	3500
Aviation Service, Hartford, Conn.	YOC	Jacobs 225	662 hr.	100 hr.	3300
Chicago School of Aero, Mt. Prospect, Ill.	ZQC	Jacobs 285	790 hr.	500 hr.	3285
Aviation Service, Hartford, Conn.	YOC	Jacobs 225	670 hr.		3200
E. W. Wiggins Airways, Providence, R. I.	Custom	Wright 285	300 hr.	100 hr.	3000
Sterling Airways, Sterling, Col.	YKS Cabin	Jacobs 225	350 hr.	48 hr.	3000
California Aircraft, Van Nuys, Cal.		Jacobs 285	512 hr.	66 hr.	3000
Sioux Skyways, Sioux Falls, So. Dakota		Jacobs 225	750 hr.	300 hr.	2985
Mississippi Airways, Jackson, Miss.		Jacobs 225	295 hr.		2800
R. Turner Aero Corp., Indianapolis, Ind.		Jacobs 225			2750
N. R. McCray, Arpt., Jamestown, N. Y.	CSTD	Jacobs 225	380 hr.	275 hr.	2650
Cape Aircraft, Inc., Hatchville, Mass.		Jacobs 225	508 hr.	17 hr.	2500
J. Ruzicka, Circus City Arpt., Peru, Ind.	Cabin	Jacobs 225	700 hr.	110 hr.	2500
Calkins Arcft., 1022 N. Atlantic, Spokane, Wash.	UIC-4-PCLB	Cont. 210	921 hr.	just	2450
Air Service, Arpt., Denver, Col.	Custom	Jacobs 225	900 hr.	175 hr.	2400
B. F. Hines, Mex.-Tex. Arpt., Hobbs, N. M.		Jacobs 210	400 hr.		2100
Phillips Flyg. Serv., Mt. Pleasant, Mich.		Cont. 210	470 hr.		2000
Beebe Air Serv., Hastings, Neb.		Cont.	450 hr.	Dec. '39	2000
Tenn. Aero Corp., Nashville, Tenn.		Cont. 210			2000
J. P. Hall, Arpt., West Haven, Conn.	F-2	Cont. 165	300 hr.	50 hr.	2000
J. L. Wells, 106 W. Main, Avon Park, Fla.	YKC	Jacobs 225	650 hr.	200 hr.	2000
Speed's Flyg. Serv., Jackson Hts., N. Y.	RNF	Warner 125	850 hr.	80 hr.	1800
W. F. Luke, Airport, Schenectady, N. Y.		Cont. 210	525 hr.	100 hr.	1650
Airways, Inc., Waterville, Me.		Cont. 210	640 hr.	138 hr.	1600
Clinton Co. Arpt., De Witt, Ia.		Warner 125	450 hr.	100 hr.	1500
B. Frame, Lovell Arpt., Chattanooga, Tenn.		Cont. 165	826 hr.		1495
Falcon Aircraft, Inglewood, Cal.	Cabin	Cont. 210	800 hr.	150 hr.	1495
Lexington Flyg. Serv., Lexington, Ky.		Jacobs	680 hr.	127 hr.	1475
Reifenberg Aviation, St. Johns, Pa.		Cont. 165	485 hr.		1395
Aviation Service, Hartford, Conn.	QDC	Cont. 165	1075 hr.	200 hr.	1350
Bishop Flyg. Serv., Arpt., Flint, Mich.	F	Kinner 125	1395 hr.	1030 hr.	1350
Aviation Service, Hartford, Conn.	QDC	Cont. 165	463 hr.	87 hr.	1350
Frantz Flyg. Serv., Roanoke, Va.		Cont. 165	475 hr.		1275
Walz Corp., Central Arpt., Camden, N. J.	Cabin	Cont. 210	1658 hr.	1658 hr.	1275
Arents Air Serv., Armonk, N. Y.	OEC	Kinner 210	775 hr.	40 hr.	1275
Aviation Service, Newport News, Va.		Kinner B-5	650 hr.	100 hr.	1200
Louisville Flyg. Serv., Inc., Louisville, Ky.		Cont. 210	768 hr.		1195
SE Kansas Aircraft, Chanute, Kans.		Warner		150 hr.	1150
O. E. Dickerhoof, Chanute, Kans.		Warner 125	450 hr.		1150
Baker-Eberle, Detroit, Mich.	F	Warner 125	600 hr.	recently	1150
G. C. Haven, Schenectady, N. Y.		Warner 125	1000 hr.	200 hr.	1100
Aero Serv., Canton, Ohio.	Str. Wing	Wright J-5	800 hr.	40 hr.	1100
Northern Air Service, Grand Rapids, Mich.	KNF	Kinner 100	954 hr.	yes	1075
Southern Air Serv., Memphis, Tenn.		Warner 125	1000 hr.	recently	1050
Chapman Air Serv., New Orleans, La.		Warner		50 hr.	1050
Seidner Flyg. Serv., Youngstown, Ohio.	ASO	Wright J-5	795 hr.	14 hr.	995
N. R. McCray, Airport, Jamestown, N. Y.	F	Warner 125	680 hr.	575 hr.	995
Ranger Flyg. Serv., Ranger, Texas.	RNF	Warner 125	1050 hr.	(1939)	975
Aero Ways, Inc., Cleveland, Ohio.		Warner	801 hr.		950
Greenville School of Aviation, Greenville, O.	F	Kinner 125	1100 hr.	June '40	950
Cincinnati Aircraft Serv., Cincinnati, O.		Warner 125	950 hr.		925
N. E. McCray, Airport, Jamestown, N. Y.	A	Jacobs 170	575 hr.	525 hr.	895
Des Moines Flyg. Serv., Des Moines, Ia.	F	Warner 125	688 hr.	10 hr.	765
Currey Flyg. Serv., Galesburg, Ill.		Tank 115	500 hr.	30 hr.	550
Jesse Jones, Airport, Lancaster, Pa.	GE	Tank 115	250 hr.	20 hr.	550

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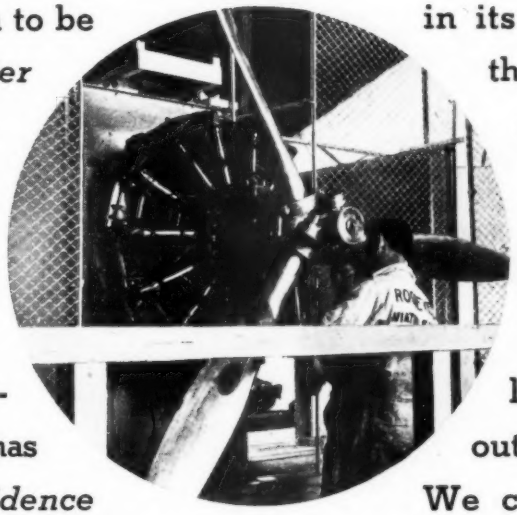

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